Trading Strategy and Behavior of Various Investor Types between Spot and Futures Market: Evidence from Thailand

Submitted to Middlesex University in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy

Tipprapa Reancharoen
M00382618

Department of Economics and International Development,
Middlesex University Business School

December 2015

Abstract

In rational, efficient market, returns on derivative and underlying securities should be perfectly contemporaneously correlated. Due to market imperfections, one of these two markets may reflect information faster. The thesis analyzes the lead-lag relationship between the spot market and futures market, SET50 index and its futures contract, for the Thailand market. Various econometric tools like unit root tests and the Error-Correction Model (ECM) were employed in the study. The Augmented Dickey Fuller tests employed in the study proved that both the selected markets were stationary series after first difference and the Granger Causality test proved unidirectional relationships between these markets.

On the daily observations basis, the results show that there is a price discovery for the futures index. In other words, the lagged of changes in spot price has a leading effect to the changes in the futures price. Alternatively, the TDEX is used instead of the SET50 index to see any changes in the lead-lag relationship. The result proves that there is a leading effect between TDEX and SET50 index futures. The ECM, which utilizes the traditional linear model, is considered to be the best forecasting model. The trading strategy based on this model can outperform the market even after allowing for transaction costs.

Moreover, this thesis studies the trading patterns of each investor type, which are foreign investors, institutional investors, and individual investors by using detailed records of trading activity, trading volume, and trading value by employing a unique data set of daily aggregated purchases and sales on the Stock Exchange of Thailand

(SET) and the Thailand's derivative market. The results show that the buying and selling investment flows of these three investor groups are ranked as follows; the majority trader in the Stock Exchange of Thailand (SET) is the individual investor, followed by the foreign investor, and the institutional investor. The corresponding ranking in the Thailand's Derivative Market is the individual investor, then the institutional investor, and the foreign investor is the minority trader.

The results provide empirical evidence that foreign investors were net buyers whereas institutional investors and individual investors were net sellers of equities in both the spot and the futures market of Thailand. For the feedback-trading pattern, the results show that in both the spot and the futures market; foreign investors are positive feedback or momentum traders. While, individual investors tend to be contrarian investors, or negative feedback traders. Institutional investors' trading pattern in both spot and futures market is rather mixed results. Furthermore, the results show that foreign investors' herding is positively correlated with institutional traders in spot market, while negatively correlated with institutional investors in futures market. Foreign investors' herding is negatively correlated with individual investors in both spot and futures market. Institutional investors' trade flow is positively correlated with individual investor in futures market whereas it is negatively correlated with individual investors in spot market.

In addition, this thesis studies trading performance of various investor types, which are foreign investors, institutional investors, and individual investors on the Stock Exchange of Thailand (SET) and Thailand's derivative market. The results reveal that different investor types can have different performance. Foreign investors who

are more likely to have information advantage over other type make minor overall net trading gains in the futures market, their gains arise from the good market timing but likely to incur large losses in the spot market from negative price spreads between sell and buy prices. Individual investors in the spot market experience positive return, they have success in performance from price spread whereas they experience poor market timing return. Moreover, the results exhibit that individuals make losses on their trade in the futures market. Specifically, the results show that institutional investors make overall net trading gains from positive price spreads between sell and buy prices in both spot and futures market. The different performance might be due to mixed effect of the trading gains and losses arise from trades between investor types that have different backgrounds.

Acknowledgements

Perhaps the most pleasant stage in a research is when the researcher comes to acknowledge the help and support of those who willingly gave their time and resources to help. This thesis is the result of not only my hard work but also the support of many people, I am heavily indebted and would like to express my sincere gratitude to all who contributed in various ways to make this study a success.

First of all, I am deeply grateful and would like to specially thank to my Director of Study, Dr. Amrit Judge for his great support, excellent guidance, and constructive and constant supervision throughout the period of this thesis. Without the valuable guidance and advices, I could not imagine how I can accomplish this thesis. I am also indebted and thankful to Dr. Xufei Zhang, my joint Director of Study as Dr. Judge is now working at Nottingham University. Their welcoming attitude and long experience in academia have helped me the most in completing this study.

I would also like to express my special thank to Professor Atanu Ghoshray and Dr. Michela Vecchi for their constructive comments and suggestions. I am thankful to all the academic staff and lecturers for their kind support and many thanks also go to Middlesex University Business School, which gave me the opportunity to do this research. Thanks also go to all the people who have directly or indirectly helped me during the PhD years.

Finally, I would like to thank and express my love and gratitude to my family and friends for their love, encouragement, understanding, and support while I was doing this research.

Any remaining errors are entirely my responsibility.

Declaration of Originality

I hereby declare that this project is entirely my own work and that any additional sources of information have been duly cited.

I hereby declare that any internet sources, published or unpublished works from which I have quoted or drawn reference have been reference fully in the text and in the contents list. I understand that failure to do this will result in a failure of this project due to Plagiarism.

I understand I may be called for a viva and if so must attend. I acknowledge that is my responsibility to check whether I am required to attend and that I will be available during the viva period.

Signed:.....

Date:.....

Name of Supervisors: Dr.Amrit Judge & Dr.Xufei Zhang

Table of Contents

Abstract ..... **ii**

Acknowledgements ..... **v**

Declaration of Originality ..... **vii**

Table of Contents ..... **viii**

List of Tables ..... **xiii**

List of Figures ..... **xvi**

Table of Abbreviations ..... **xviii**

Chapter 1. Introduction **1**

1.1 Why is it important to Thailand? **10**

1.2 Thailand Overview **13**

1.2.1 Background of Thailand 13

1.2.2 Thailand's Economy 14

1.2.3 Thailand Financial Markets 15

1.2.3.1 Structure of Thai Financial Markets 15

1.2.3.2 Main Financial Markets in Thailand 18

1.3 Aims and Objectives of the Study **21**

1.4 Statement of Problem/ Research Question **22**

1.5 Contributions **23**

1.6 Structure of the Study **23**

Chapter 2. Literature Review **26**

2.1 Introduction **26**

2.2 Theoretical Framework and Consideration **26**

2.2.1 Efficient Market Theory 27
2.2.2 Cointegration Theory 28
2.2.3 Market Efficiency and Cointegration 29
2.2.4 Cointegration and the Theoretical Relation between Time Series 31
2.2.4.1 Error Correction Model 31
2.2.4.2 Cost of Carry Model 33
2.2.5 Price Discovery and Spot-Futures Market Interaction 34
2.2.5.1 Futures Prices Tend To Influence Spot Prices 35
2.2.5.2 Spot Prices Tend To Lead Futures Prices 36
2.2.5.3 Bidirectional Feedback Relationship Exists between Spot and Future Prices 36
2.2.6 Investor Trading Behavior 37
2.2.6.1 The Information-Based Trading 37
2.2.6.2 The Behavioral-Based Trading 38
2.2.7 Momentum and Contrarian 38
2.2.8 Investor Trading Performance 40
2.2.8.1 Behavioral Biases and Investor Performance 41
2.2.8.1.1 Overconfidence Traits 41
2.2.8.1.2 Disposition Effect 42
2.3 Empirical Literatures 44
2.3.1 Empirical Studies Examining the Relationship between the Spot and the Futures Market 44
2.3.2 Empirical Studies Considering the Trading Patterns of Various Investor Types .58
2.3.2.1 Trading Pattern of Foreign Investor 75
2.3.2.2 Trading Pattern of Institutional Investor 76
2.3.2.3 Trading Pattern of Individual Investor 77
2.3.3 Empirical Studies Investigating the Trading Performance of Different Types of Investors 79

2.3.3.1 Trading Performance of Foreign Investor....94
2.3.3.2 Trading Performance of Institutional Investor....96
2.3.3.3 Trading Performance of Individual Investor....98
2.5 Summary and Conclusion....100
Chapter 3. Data and Methodology....104
3.1 Introduction....104
3.2 Data....104
3.2.1 Background on the Thailand Financial Markets....104
3.2.2 Background on the Stock Exchange of Thailand and Thailand's Derivatives Market....105
3.2.3 Data Collection Method....106
3.2.3.1 Data Collection Methods in Chapter 4....106
3.2.3.2 Data Collection Methods in Chapter 5....108
3.2.3.3 Data Collection Methods in Chapter 6....109
3.2.4 Data Analysis Method....110
3.2.4.1 Data Analysis Methods in Chapter 4....110
3.2.4.2 Data Analysis Methods in Chapter 5....113
3.2.4.3 Data Analysis Methods in Chapter 6....121
3.3 Methodology....126
3.3.1 A Test of Stationarity....127
3.3.2 Cointegration Test....128
3.3.2.1 Engle and Granger's Two-Step Procedure....129
3.3.2.2 Cost of Carry Model....131
3.3.3 Error Correction Model....132
3.3.4 Lead-Lag Relationship....134
3.3.5 Robustness Check....135
3.3.6 Forecasting Accuracy....136

3.3.7 Trading Strategy 137
3.3.8 Trading Patterns 138
3.3.9 Trading Performance 142
3.4 Summary and Conclusion 149

Chapter 4. An Empirical Examination of the Lead-Lag Relationship between Spot and Futures Market: Evidence From Thailand 151

4.1 Introduction 151
4.2 Background 152
4.3 Findings and Results 155
4.3.1 Descriptive Statistics 155
4.3.2 Correlation 157
4.3.3 Stationary Test 158
4.3.4 Cointegration Test 160
4.3.5 Error Correction Model 163
4.3.6 Lead-Lag Relationship 166
4.3.7 Robustness Check 169
4.3.8 Forecasting Accuracy 176
4.3.9 Trading Strategy 177
4.3.9.1 The Strategy: Buy Predicted Positive and Sell Predicted Negative 178
4.3.9.2 The Trading Profits: Gain or Loss? 179
4.4 Summary and Conclusion 180

Chapter 5. How Different Types of Investors Behave between Spot and Futures Market in an Emerging Market: New Empirical Evidence from Thailand 183

5.1 Introduction 183
5.2 Background 184
5.3 Findings and Results 186
5.3.1 Descriptive Statistics 187

5.3.2 Augmented Dickey-Fuller Test 189
5.3.3 Correlation 192
5.3.4 Vector Autoregression (VAR) Model 195
5.4 Summary and Conclusion 200

Chapter 6. Investors' Performance and Trading Sources between Spot and Futures Market in an Emerging Market: New Empirical Evidence from Thailand 204

6.1 Introduction 204
6.2 Background 205
6.3 Findings and Results 212
6.3.1 Descriptive Statistics 212
6.3.2 Investment Performance of Investor Groups 216
6.3.3 Trading Performance of Different Types of Investors between Spot and Futures Market 217
6.4 Summary and Conclusion 242

Chapter 7. Conclusion 246

7.1 Introduction 246
7.2 Summary of the Thesis 246
7.3 Empirical Findings 247
7.3.1 Chapter Four – Empirical Findings and Discussion 248
7.3.2 Chapter Five – Empirical Findings and Discussion 250
7.3.3 Chapter Six – Empirical Findings and Discussion 253
7.4 Contributions of the Thesis 255
7.5 Limitations and Recommendation for Further Research 256
7.6 Summary and Conclusion 257

References 259

List of Tables

Table 2-1: Empirical studies examining the relationship between spot and futures market. 45

Table 2-2: Empirical studies considering the trading patterns of various investor types. 59

Table 2-3: Empirical studies considering the trading performances of various investor types. 80

Table 3-1: Summary statistics of daily equity sales and purchases (unit: Million Baht) 118

Table 3-2: Summary statistics of daily equity sales and purchases (unit: contracts). 119

Table 3-3: Summary statistics of daily equity sales and purchases in the spot market 121

Table 3-4: Summary statistics of daily sales and purchases in the futures market . 124

Table 4-1: Descriptive Statistics 156

Table 4-2: Correlation 158

Table 4-3: Results of ADF tests in level and first difference form 159

Table 4-4: Cointegration Test 162

Table 4-5: Error-correction Model 165

Table 4-6. Wald Test 168

Table 4-7: Results of ADF tests in level and first difference form for TDEX 171

Table 4-8: Cointegration test for TDEX 172

Table 4-9: Error-correction model for TDEX 174

Table 4-10: Comparison of out-of-sample forecast for $\Delta \ln F_t$ 176

Table 4-11: Trading Strategy Returns 179
Table 5-1: Summary statistics of daily net investment flow (unit: Million Baht) .. 187
Table 5-2: Summary statistics of daily net investment flow (unit: Contracts) 188
Table 5-3: Results of Augmented Dickey-Fuller (ADF) tests in the Spot Market of Thailand 190
Table 5-4: Results of Augmented Dickey-Fuller (ADF) tests in the Futures Markets of Thailand 190
Table 5-5: Correlation of daily net investment flow of all types of investors in spot market 192
Table 5-6: Correlation of daily net investment flow of all types of investors in futures market 192
Table 5-7: Correlation of daily net investment flow and the return of SET in spot market 193
Table 5-8: Correlation of daily net investment flow and the return of SET futures in futures market 193
Table 5-9: VAR model estimates of net investment flow and SET return 196
Table 5-10: VAR model estimates of net investment flow and SET futures return 197
Table 6-1: Summarizes the net value and the net volume of the spot and futures market 216
Table 6-2: Wilcoxon signed rank test. Performance comparison in the spot market 225
Table 6-3: Wilcoxon signed rank test. Performance comparison in the futures market 227
Table 6-4: Correlation of trading performance in the spot market 230
Table 6-5: Correlation of trading performance in the futures market 233

Table 6-6: Correlation of investor group performance in the spot market 236

Table 6-7: Correlation of investor group performance in the futures market 239

List of Figures

Figure 1-1: Trading volume of the spot and futures markets in Thailand 12

Figure 3-1: The structure of financial market in Thailand 105

Figure 3-2: SET50 index and SET50 index futures 111

Figure 3-3: Frequency distribution..... 112

Figure 3-4: Boxplots (SET50 index and SET50 index futures) 113

Figure 3-5: Trading value of both buying and selling side of all types of investors 114

Figure 3-6: Trading volume of both buying and selling side of all types of investors 116

Figure 4-1: The price movement of spot index and futures index during the sample period..... 155

Figure 4-2: Scatter-plot matrix of lnspot and lnfutures index..... 157

Figure 4-3: The price movement of SET50 index and TDEX in the trading period 170

Figure 6-1: The daily trading value and the proportion of that value in the total trading value between year 2011 and year 2014 on the spot market in Thailand for three investor groups 213

Figure 6-2: The daily trading volume and the proportion of that volume in the total trading volume between year 2011 and year 2014 on the spot market in Thailand for three investor groups 214

Figure 6-3: The daily trading value and the proportion of that value in the total trading value between year 2011 and year 2014 on the futures market in Thailand for three investor groups 215

Figure 6-4: The daily trading volume and the proportion of that volume in the total trading volume between year 2011 and year 2014 on the futures market in Thailand for three investor groups 215
Figure 6-5: Cumulative performance. The comparison of the performance of market timing of each type of investors in the spot market 219
Figure 6-6: Cumulative performance. The comparison of the performance of market timing of each type of investors in the futures market 219
Figure 6-7: Cumulative performance. The comparison of the performance of price spread of each type of investors in the spot market 221
Figure 6-8: Cumulative performance. The comparison of the performance of price spread of each type of investors in the futures market 221
Figure 6-9: Cumulative performance. The comparison of the overall net trading performance of local institutions, foreign investors, and individual traders in the spot market 222
Figure 6-10: Cumulative performance. The comparison of the overall net trading performance of local institutions, foreign investors, and individual traders in the futures market 223

Table of Abbreviations

ADF	Augmented Dickey–Fuller
AFET	Agricultural Futures Exchange of Thailand
AIC	Akaike Information Criterion
ATC	At the Close Order
BEX	Bond Electronic Exchange
BIBOR	Bangkok Interbank Offered Rates
BMV	Base Market Value
BOT	Bank of Thailand
BSE	Bangkok Stock Exchange
CAC	Cotation Assistee en Continuo or Continuous Assisted Quotation
CMV	Current Market Value
COC	Cost of Carry
CPI	Commodity Price Index
CRB	Commodity Research Bureau
DF	Dickey Fuller
DS	Difference-Stationary
ECM	Error-Correction Model
EMH	Efficient Markets Hypothesis
ETF	Exchange-Traded Fund
Eviews	Econometric Views
FTSE	Financial Times Stock Exchange
FX	Foreign Exchange

GARCH	Generalized Autoregressive Conditional Heteroskedasticity
GDP	Gross Domestic Product
IQR	Interquartile Range
JSX	Jakarta Stock Exchange
KOSDAQ	Korean Securities Dealers Automated Quotations
KSE	Korea Stock Exchange
MAE	Mean Absolute Error
MAI	Market for Alternative Investment
MAPE	Mean Absolute Percentage Error
MDGs	Millennium Development Goals
M-GARCH	Multivariate Generalized Autoregressive Conditional Heteroskedasticity
MMI	Major Market Index
NIF	Net Investment Flow
NSA	Nikkei Stock Average
NYSE	New York Stock Exchange
OLS	Ordinary Least Squares
OTC	Over the Counter
PACAP	Pacific-Basin Capital Market Research Center
PDs	Primary Dealers
PSE	Philippine Stock Exchange
RMSE	Root Mean Squared Error
RSS	Residual Sum of Squares
RWM	Random Walk Model

SEC	Securities Exchange Commission
SET	Stock Exchange of Thailand
SETSMART	SET Market Analysis and Reporting Tool
SPSS	Statistical Package for the Social Sciences
STRIPS	Separate Trading of Registered Interest and Principal of Securities
S&P	Standard & Poor's
T-bill	Treasury Bill
TBMA	Thai Bond Market Association
TDEX	ThaiDex SET50 Exchange-Traded Fund
TFEX	Thailand Futures Exchange
TSD	Thailand Securities Depository
TWSE	Taiwan Stock Exchange
VAR	Vector Auto Regressive
VECM	Vector Error Correction Models

Chapter 1. Introduction

In efficient financial-market information flow is assumed to be frictionless, it follows from this that changes in a spot stock market index and its associated future price should be instantaneously and simultaneously reflected for the changes in the factors that affect them. If a market is efficient, both spot prices and futures prices[1] should react to new information simultaneously, and there is no lead–lag relationships between one market and the other.

However, many studies have found that this is not the case in the real world. Several papers have found that the futures price leads its underlying index such as Ghosh (1993), Tse (1995), Shyy, Vijayraghavan and Quinn (1996), So and Tse (2004), and Kang et al. (2006). Some argued that the spot index leads its associated futures index such as Lucian (2008), Bohl, Salm and Wilfling (2009), Cabrera, Wang and Yang (2009), Chen and Gau (2009) ,and Yang, Yang and Zhou (2012). While some papers discovered the bidirectional relationship such as in Pizzi et al. (1998), Gee and Karim (2005), and Jackline and Deo (2011). According to Brooks, Rew, and Ritson (2001), they argued that market sentiment and an arbitrage trading are the major of determinants linking stock index futures and spot index. A study by Kung and Carverhill (2005) on the U.S. Treasury Separate Trading of Registered Interest and Principal of Securities (STRIPS) with different time to maturity shows that spot and

[1] The spot price is the current price at which a particular security can be bought or sold at a specified time and place. A security's spot price is regarded as the explicit value of the security at any given time in the marketplace. In contrast, the futures price refers to the expected value of the security, in relation to its current spot price and time frame in question, which are prices at which an asset can be bought or sold for delivery in the future.

futures prices are cointegrated and that no arbitrage profit can be made after taking liquidity and transaction costs into consideration.

However, some researchers believe that both futures markets and options markets may contain more information than the spot market, because traders in these markets are generally large traders and are better informed. Some empirical studies find evidence that supports information efficiency in spot and futures market. For example, Wahab and Lashgari (1993) study the Standard & Poor's 500 index (S&P 500) and the Financial Times index spot and futures prices, and although they find futures prices weakly lead spot prices, the magnitude is too small to generate any arbitrage profit. They conclude that their results are consistent with market efficiency.

This issue has been extensively studied in various financial markets as well as commodity markets[2]. Generally, it is often believed that futures markets potentially provide a profound process of price discovery. Price discovery performance of futures markets is an important issue that has received a lot of attention in the literature. Price discovery in futures markets is commonly defined as the use of futures prices to determine expectations of cash market prices, and the price discovery performance of futures markets is crucial to the use of these markets. As asset prices appear to exhibit non-stationarity, a number of studies investigate the

[2] Commodity markets refers to physical or virtual marketplaces for buying, selling, and trading raw or primary products. For investors' purposes there are currently about 50 major commodity markets worldwide that facilitate investment trade in nearly 100 primary commodities. Commodities are split into two types: hard and soft commodities. Hard commodities are typically natural resources that must be mined or extracted (gold, rubber, oil, etc.), whereas soft commodities are agricultural products or livestock (corn, wheat, coffee, sugar, soybeans, pork, etc.)

price discovery role of futures markets in a cointegration[3] or related error correction model framework. See, for example, Ghosh (1993), Brenner and Kroner (1995), Yang, Bessler, and Leatham (2001), Chatrath, Christie-David, Dhanda, and Koch (2002), and Yang, Yang, and Zhou (2012).

Price discovery, according to Schreiber and Schwartz (1986), is the process in which markets attempt to reach equilibrium prices. Therefore, when observing the lead-lag effect, the price or movement of futures should contain useful information for its subsequent spot prices. Such effect illustrates how fast futures market reflects new information relative to its spot market. Under the perfectly efficient market hypothesis[4], where all available information is fully utilized, arbitrage activities will keep futures and spot price move more synchronous. These two markets should be contemporaneously correlated which is not consistent with the implication of lead-lag effect. In fact, due to market frictions non-synchronous movement between futures and spots markets are observed. The reasons for this lead-lag effect may be attributed by less restrictive regulation or lower transaction costs in futures markets. Comparing with its stock market, liquidity and financial leverage due to permissive short selling and marked to market trading may accelerate the speed of price discovery process.

[3] Cointegration is a statistical property of time series variables, whereby two or more time series are cointegrated if they share a common stochastic drift. Testing for cointegration between variables with unit roots is an integral part of empirical time series analyses. A number of tests are available in the literature. The well-known tests, suggested by Engle and Granger (1987) is to run a static regression two-step approach and Johansen and Juselius (1990)'s maximum likelihood estimation procedure.

[4] The term 'market efficiency', presented by Fama (1970), is generally referred to as the informational efficiency of financial markets, which emphasizes the role of information in setting prices. More specifically, the efficient markets hypothesis (EMH) defines an efficient market as one in which new information is quickly and correctly reflected in its current security price. Fama (1970) outlines the classic taxonomy of information sets available to market participants and further classifies the EMH into the weak-form, semi-strong-form and strong-form.

When the new information comes, the futures trading can be executed immediately with little cash outlay, as futures are a levered instrument compared to the actual underlying stocks, which would require a greater up-front investment and a probable longer time to implement. Thus, this transaction preference may explain why lead-lag relationship is observed in many studies.

Given the mixed empirical findings, the question naturally arises: what are the actual relationships between spot SET50 and SET50 futures prices? Trading futures also has the advantage of highly liquid market, easily short position, leverage position, and rapid execution. These advantages might move the futures price first and then lead the stock index when arbitrageurs respond to the deviations from the cost of carry relationship. Futures price may provide a sentiment indicator for the stock index when investors who are unable or unwilling to utilize futures integrate the same information into their spot market transaction.

Moreover, the finance and economics literatures continue to debate whether the market is efficient. Empirical evidence that appears to strongly contradict the random walk hypothesis has recently spurred the development of what has come to be known as behavioral finance. Theories of investor under- and overreaction to news are being put forth to explain return patterns such as momentum and contrarian[5]. The assumptions behind these theories of investor behavior are founded in psychological research or common sense. Clearly, however, this line of research could benefit from

[5] Momentum investing refers to the purchase of past winners and the sale of past losers, and for the market as a whole to net purchasing when the market has been rising as well as selling when the market has been falling. Contrarian trading is the reverse (buying a stock, or the market as a whole, when it has been falling, and vice versa).

a more complete picture of how investors actually behave and how they differ from one another in the way they react to the same information.

There are three forms of market efficiency, which are strong-form efficient, semi-strong form efficient and weak-form efficient. In testing market efficiency, researchers examine whether the market fully reflects information contained in the past. Up to date, there is no overwhelming consensus on this issue. There are many anomalies [6] identified in historical stock returns such as the contrarian and momentum effect, which has caught much attention in the finance and economics research.

Investors may trade for a variety of reasons such as liquidity reasons, portfolio rebalancing, lifecycle considerations, purely speculative reasons, or overconfidence. Trading may also be driven by changes in investor beliefs about the future stock prices and these beliefs are likely to be influenced by past price trends. Along with the fundamental information about the firm, investors may look at price trends to formulate their trading decisions and they may follow trend-based heuristics such as momentum and contrarian strategies to decide when to buy and when to sell.

A number of recent empirical studies have investigated the trading behavior of different investor types such as foreign, institutional, and individual investors. For instance, Odean (1998, 1999) finds contrarian tendency of individual investors' behavior in the U.S. Richards (2005) indicates that individual investors in Asian equity markets follow contrarian trading, Nofsinger and Sias (1999) find the trading

[6] Financial market anomalies are cross-sectional and time series patterns in security returns that are not predicted by a central paradigm or theory. The term anomaly can be traced to Kuhn (1970). Documentation of anomalies often presages a transitional phase toward a new paradigm.

behavior of U.S. institutional investors follow momentum trading patterns. Cai and Zheng (2004) present momentum trading of institutional investors in US. Choe et al. (1999) investigate daily trading patterns and herding behavior in Korea. Grinblatt and Keloharju (2000) examine investment strategies of different investor types in Finland and find individuals and institutions follow contrarian trading strategies while foreigners follow momentum investment strategies. Lin and Swanson (2003) find that foreign investors in Taiwan employ momentum trading strategies.

An extensive body of finance literature documents that past stock returns can predict the future stock returns in short-, intermediate- and long-term horizons, although the predictability weakens over longer horizons. For example, Jegadeesh (1990) and Lehmann (1990) find return reversals in relatively short-term horizons. Jegadeesh and Titman (1993) document return continuations in intermediate horizons where, on average, past winners continue to outperform past losers. DeBondt and Thaler (1985, 1987) report long-term price reversals where past long-term losers outperform past long-term winners. Given such time-series patterns in cross-sectional stock returns, one can formulate two portfolio-investment strategies: contrarian and momentum strategies. Under the contrarian strategy, past losers are bought and past winners are shorted or sold. Under the momentum strategy, past winners are bought and past losers are shorted or sold.

Therefore, one of the aims of this research is to empirically examine the existence of momentum and contrarian effects in the Thailand's stock markets and to investigate trading patterns of each type of investors, which are foreign investors, institutional investors, and individual investors in both the Stock Exchange of Thailand (SET)

and Thailand's Derivative Market. The study of trading behavior becomes increasingly important role in order to help facilitate the development of the capital market, especially in an emerging market. However, regarding investors from emerging markets, the knowledge about their investing behavior is very limited. Therefore, to address this gap in the literature, in this research, I present the trading patterns of various investor types and differentiate this work from previous studies by focusing on both the Stock Exchange of Thailand (SET) and Thailand's Derivative Market. This research contributes to the existing literature in the following ways. Firstly, this research fills the gap in the literature by investigating the existence of momentum and contrarian in the Thai markets, Thailand remains among the most important emerging markets awaiting such investigations because the volume of the trading in both the spot and futures markets in Thailand has been increasing over time (see Figure 1-1).

Furthermore, for a variety of reasons, academic research tends to view the foreign, institutional, and individual investors differently. Foreign and institutional investors are believed to be better informed, are financially sophisticated, and are much larger than individual investors. Individual investors, on the other hand, are considered to have psychological biases and may succumb to heuristic simplification in their decision-making. This corresponds to two categories of theoretical models about investor trading decisions, which are rational (information-based trading)[7] and irrational (behavioral-based trading)[8] investors. Therefore, in this paper, I would like to examine whether the significant differences in their trade performances result from different trading decision assumptions. Under two main trading decision

[7] See Hasbrouck (1991) and Easley et al. (1997) for more details
[8] See Goetzmann & Massa (2003) and Chen (2004) for more details

assumptions; the first assumption is whether the rational (information-based trading) investors; foreign and institutional investors have superior information for future stock returns. The second assumption is whether the irrational (behavioral-based trading) investors; individuals have inferior returns.

A somewhat similar picture has also been painted for emerging markets where some studies have found that foreign investors follow information-based, momentum trading strategies, with foreign investment inflows foreshadowing good subsequent returns (Froot et al., 2001). The superior trading performance of foreign investors in emerging markets, presumably at the expense of (less sophisticated) individual investors who take the other sides of foreigners' trades, raises a number of questions as to the sources of the trading performance. Is the superior performance of foreign investors in emerging markets due to good market timing, price spread, or both? How do individual investors in emerging markets perform in terms of market timing, security selection, and (consequently) overall trading performance? How do other (presumably information-based) institutional investors behave in emerging markets, and what is their market timing and security selection performance? This paper therefore examines in detail the trading behavior as well as the market timing and security selection performance of investor types in a dynamic emerging market, the Thai stock market and the Thai futures market.

Several papers find evidence of foreign investors generate superior trade performance such as Grinblatt and Keloharju (2000) examine investors in Finland and Froot et al. (2001) investigate daily cross-border flows for 44 countries. In contrast, Brennan and Cao (1997) present the foreign investors in U.S. achieve

inferior performance because they are less informed than domestic investors. Similarly, Choe et al. (2004) find no evidence of better-informed foreign investors in Korea and *Dvoř a′k* (2005) finds domestic investors in Indonesia have an information advantage over foreign investors on average, resulting in domestic investors have higher profits than foreign investors. While, Barber and Odean (2001) indicate that individual investors in the United States get poor net returns when comparing against the various benchmarks such as the multifactor benchmark and the market portfolio. Barber et al. (2004) find institutional investors gain positive excess returns whereas individual investors have poor market return the Taiwanese stock market.

A simultaneous analysis of the investment behavior and performance of all investor categories has been impossible until now because of data limitations. Different research methods, different data frequencies, different horizons for past returns, and different institutional arrangements unavoidably blur the comparison of the results and make it difficult to identify general patterns behind the behavior and performance of isolated investor categories. In this paper, I examine trading sources and performance of different types of traders in Thailand. I employ trade-weighted measure of trading performance using buy and sell volumes and values, which is developed by Bae et al (2006). This is more powerful performance measurement, which not only compares the trading performance of all investor types across the entire equity market, but also measures trading gains and losses from different sources. This measure decomposes trading performances into two sources; trading price spreads, and market timing presented more complete picture of the performance of various investor types.

Besides, this study focuses on both stock and futures trading because of their relative importance in the financial marketplace. Stocks and futures markets are two of the most actively traded instruments worldwide. Moreover, the stock and futures markets are good places to look for behavioral anomalies. Referring to Warneryd (2001) describes the stock market as highly emotional. The psychological concept of investor emotions, overreactions or underreactions to information, feelings of optimism, and self-confidence are highly prevalent in the stock market, and these factors play an important part in driving investor behavior. Another motivation for this study is that stock markets are thought to be the most efficient of all markets. The futures market is also a good place to look for anomalies. Futures traders need to keep their senses sharp through hours of tumult, noise, and general confusion. They need to have skill, knowledge, persistence, motivation, and, especially, control of their emotions in order to remain psychologically rational amid the chaos that results from split-second trading.

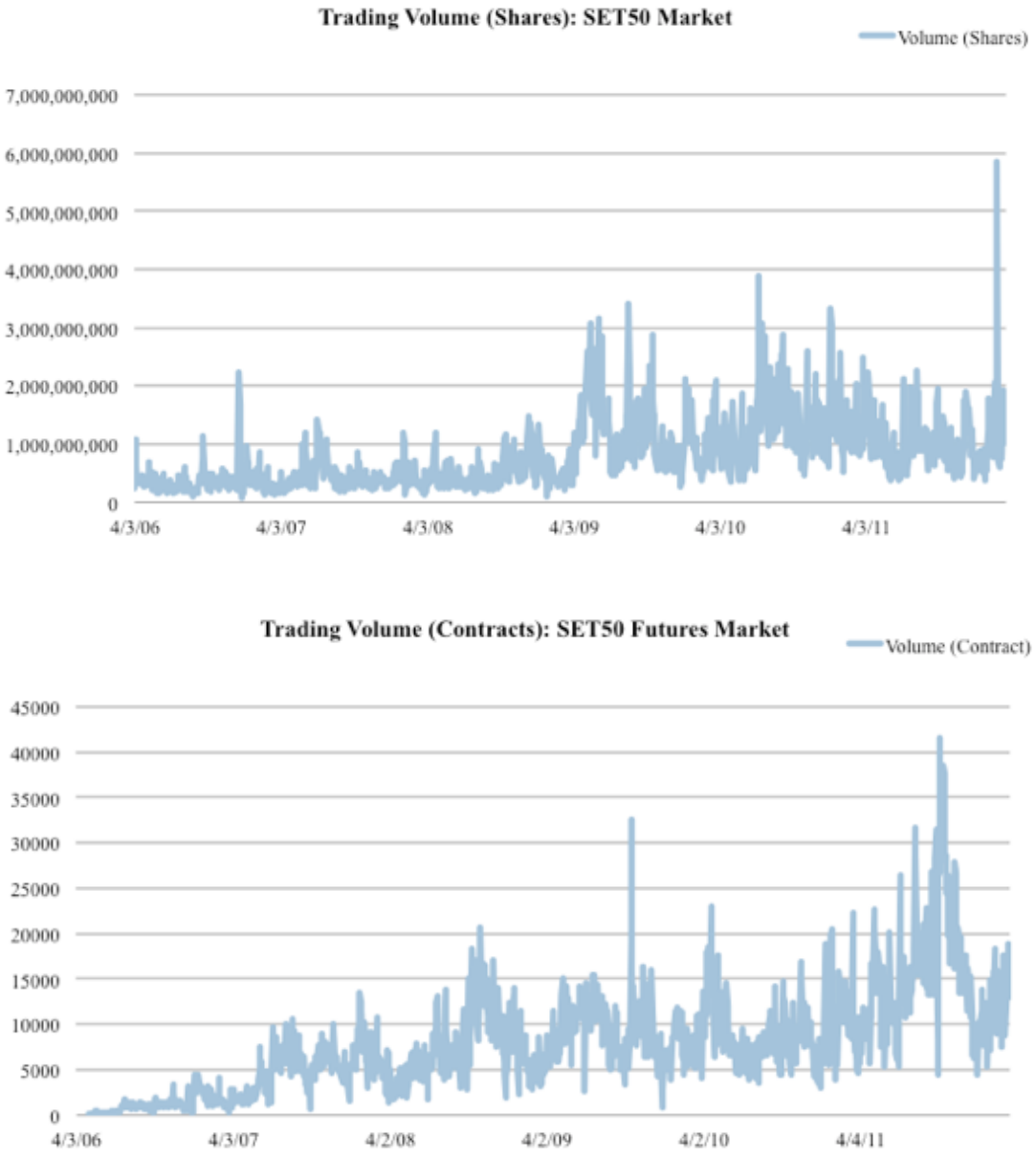
1.1 Why is it important to Thailand?

Since Thailand's stock market is said to be quite small and its derivatives market is very young, thus it is worthwhile to study the movement of the futures prices compare with its underlying to see any lead-lag relationship and consider this outcome to other markets which have the longer time period or more developed such as Standard & Poor's 500 index (S&P500 index) or Financial Times Stock Exchange 100 index (FTSE100 index). A trading strategy may also contribute the idea to the interesting question whether we can find a profitable return above a passive strategy using a mathematical model. The empirical analysis could also test for the market

efficiency and whether arbitrage opportunities exist in Thai market, spot and futures markets. In this research, I examine the lead–lag relationships between SET50 and SET50 futures prices. The lead–lag relationships between spot and futures markets reflect how quickly one market reacts to new information and to what degree the two markets are linked.

In addition, this research focus on the Thai market, which is an emerging market, while most of the previous researches focused in developed countries. Moreover, the study on the Thailand's stock markets is relatively scarce hence the investigation of momentum and contrarian strategies in the current Thailand is not only interesting to finance and economics academics but also highly relevant to investment professionals. Given the scale and prospect of the Thai markets, it is imperative to extend the thin literature on this issue. Besides, despite the fact that the momentum and contrarian issue has been a well-documented feature of stock returns, the analysis on the trading pattern of each type of investors is quite limited. This research provides more recent evidence using Thailand stock returns. Furthermore, analyzing and focusing on the trading patterns of both spot and futures market has not been investigated by prior research.

Figure 1-1: Trading volume of the spot and futures markets in Thailand.



Figures 1-1 shows the trading volume of both the spot and futures market in Thailand, the time series has been plotted since April 2006 because it is the time that the Thailand futures market came into being. Figure 1-1 shows the trading volume in the SET50 market (spot stock market) over time and shows the trend of trading volume in the Thailand futures market. It can be clearly seen that the volume trend is

upward, which means that the volume of the trading in both the spot and futures markets has been increasing over time.[9]

1.2 Thailand Overview

It is useful to present some information about Thailand. The aim of this overview is to provide the reader with information about the functioning and some characteristics of the markets involved in the analysis. This should help our understanding of some of the problems and some of the issues involved in emerging financial markets. It should also help to put the results presented in the next chapters into perspective.

1.2.1 Background of Thailand

Thailand or in official name, Kingdom of Thailand is known as the land of Smiles for many people. Kingdom of Thailand located in Southeast Asia. On the east of Thailand are Cambodia and Laos. On the south are Malaysia and the gulf of Thailand, and the Andaman Sea and Myanmar to the west. Thailand has an area of about 513,000 km^2 and the population of people is around 70 million people. The capital city of Thailand is Bangkok, which is one of the largest cities in Thailand. Thailand has their own languages, which is Thai, Northern-East Thai, and Southern Thai, and also write in Thai language (Wright, 2008). For the religion, most Thais are Buddhist, which is about 95% of people are Buddhists, 4% are Muslims, and the rest are Christian, Hindu and others. Thai people concern a lot on Buddhists religion.

[9] The trading volume data for Figure 1-1 can be found from SETSMART (SET Market Analysis and Reporting Tool), which is the web-based application from the Stock Exchange of Thailand.

They often go to the temple for blessing and there are many important religious days in Thailand (Baker and Phongpaichit, 2014).

Thailand is informally known as Siam. Most Thai people like to share their own culture to each other, so the characteristic of Thai people was seen through literature, drama, architecture, music, painting, sculpture, folk dances and so on. Thailand is governed by a constitutionals monarchy, which a Prime Minister serves as head of a parliamentary government (Wright, 2008). In addition, a hereditary Thai king functions as head of state. Thailand has been rule by many kings. The current king of Thailand is, His Majesty King Bhumibol Aduyadej (Rama IX) is the reigning monarch of the Chakri Dynasty that has ruled Thailand since the fall of Ayutthaya and the founding of the Rattakosin Era. Thailand is a country that has a very long history. The history of Thailand began in the Lan Na and Sukohthai period. Then it was conquered by the Khmer, which then move to the period of Ayutthaya. Unfortunately, Ayutthaya was overruled by Burmese invader, forcing Thai kingdom to move to the Southern part and establish a new capital call Thonburi, which rangeed from 1767-1772. After the short period, Thai Kingdom moves across the Chao Praya River and settled the new capital, which is today called Bangkok (Baker and Phongpaichit, 2014).

1.2.2 Thailand's Economy

Thailand is an emerging economy and is considered a newly industrialized country. Its economy is heavily exporting-dependent, with exports accounting for more than two-thirds of its gross domestic product (GDP). Thailand's high economic growth at

8-9% per year during the late 1980s and early 1990s was interrupted by the Asian Crisis during 1997-1998; robust growth at around 5% from 2002 to 2007 was again slowed down by the global financial crisis of 2008-2009.

Thailand's economic growth was further affected in 2009 because of global economic conditions and political uncertainty and again, in 2011, because of the devastating floods. Thailand became an upper-middle income economy in 2011. Notwithstanding political uncertainty and volatility, Thailand has made great progress in social and economic issues. As such, Thailand has been one of the great development success stories, with sustained strong growth and impressive poverty reduction. Now Thailand's economic activity is gradually returning to normal. Growth is projected to be around 4.0% in 2014. Thailand continues to make progress towards meeting the Millennium Development Goals (MDGs). It is likely to meet most of the MDGs on an aggregate basis (KTB, 2015).

1.2.3 Thailand Financial Markets

Financial market is a crucial component in the economic system. It is the engine that drives the economy, being a platform where surplus units meet deficit units and negotiate various kinds of financial agreement. The objective of financial market development is, therefore, to enhance the capability of the financial market to act efficiently as an intermediary.

1.2.3.1 Structure of Thai Financial Markets

Thai financial market consist of:

Foreign exchange market is basically an Over the Counter (OTC) market in which commercial banks that have Foreign Exchange (FX) licenses from the Bank of Thailand (BOT) are the major players. Currently, FX businesses in Thailand are under the Exchange Control Act B.E. 2485 (1942) and Ministerial Regulation No. 13 B.E. 2497 (1954) (Jeon and Seo, 2003).

Money market is a market for short-term borrowing and lending, within 1 year horizon, mainly for the purpose of liquidity management. Most of the money market transactions are unsecured interbank borrowing (clean loan), trading of short-term papers (such as Treasury Bills, BOT securities, Promissory Note, and Bills of Exchange), and Repurchase Agreement or Repo transactions. There are two types of Repo transactions; one that is between the BOT and its Primary Dealers (PDs) called "Bilateral Repo", and another between market participants called "Private Repo". In 2004, the BOT introduced to the market a short-term interbank borrowing reference yield curve called "BIBOR" (Bangkok Interbank Offered Rates). Besides commercial banks, major players in money market include financial institutions, large corporates, and large state owned enterprises (Chowdhury, 1997).

Debt market is a market for trading debt instruments. The underlying debt instruments are longer than 1 year. Bond or debt issuers offer their new debt issuance in the primary market while the resale of the debt instruments will be done in the secondary market. Issuers of debt securities can be public and private sector in either local currency or foreign currency. Features of debt range from a fixed rate bond, a

floating rate bond and index-linked bond or an inflation-linked bond. Compared with other markets, players in the debt market are relatively diverse, ranging from financial institutions, large entities to corporates, and individuals (retail investors). Moreover, in recent years, the government and the Bank of Thailand introduced saving bonds designated to retail investors and non-profit organizations. The subscription of the saving bonds through commercial banks' branches ensures better access and wider distribution to the public (Chabchitrchaidol and Permpoon, 2002).

Derivatives market is a market for trading complex financial instruments, the value of which is derived from value of underlying assets. The underlying assets could be a certain type of financial instruments (for example, bond or equity), or a certain type of commodities, and so on, as agreed to each other. Financial derivatives are generally used as a tool to hedge or manage a certain type of risks, namely, interest rate risk, exchange rate risk, price risk of financial products or commodities. In general, derivatives can be traded in forms of futures contract or options contract (Harris, 2002). In Thailand, Thailand Futures Exchange (TFEX), a subsidiary of the Stock Exchange of Thailand, was set up in 2004 to serve as an exchange for the trading of derivatives as governed by the Derivatives Act B.E. 2546 (2003). TFEX has launched SET 50 Index futures in 2006, and SET 50 Index option in October 2007 respectively. As for agricultural products derivatives, the Agricultural Futures Exchange of Thailand (AFET) was established, under the provisions of the Agricultural Futures Trading Act B.E. 2542 (1999), to run the exclusive agricultural futures exchange in Thailand regulated by the Agricultural Futures Trading Commission.

Equity market is another channel of long-term funding for business units. Holders of equity securities possess ownership in the business similar to the issuer of the securities. Return would be in a form of dividend and capital gain (Sharpe et al., 1999). The equity market in Thailand is governed by the Office of Securities and Exchange Commission and the Stock Exchange of Thailand.

1.2.3.2 Main Financial Markets in Thailand

Thailand has 4 main financial markets: The Stock Exchange of Thailand (SET) The Market for Alternative Investment (MAI) The Bond Electronic Exchange (BEX) The Thai Futures Exchange (TFEX). While primary markets such as the SET and MAI are directly regulated by the Securities Exchange Commission (SEC), secondary markets are regulated by the exchanges. The SEC is an independent state agency whose mission is to "Develop and Supervise the Thai Capital Market to Ensure Efficiency, Fairness, Transparency, and Integrity".

The Stock Exchange of Thailand (SET) Thailand's first stock market began in July 1962, when a private group established an organized stock exchange as a limited partnership. This group later became a limited company and changed its name to the "Bangkok Stock Exchange Co., Ltd." (BSE) in 1963. The exchange was rather inactive, however, and eventually closed in the early 1970s; it was argued the exchange did not succeed due to lack of government support.

The Securities Exchange of Thailand was established and began trading in April 1975 with only 14 listed securities, and this time with government backing, grew into

a thriving and active stock market today. It has formally been renamed the Stock Exchange of Thailand on 1 January 1991. The Thai stock markets performed well in 2014, despite domestic political turmoil and global volatility. The onset of prolonged political unrest in October 2013 weighed on investor sentiment during the first half of 2014. However, as political stability returned, SET index rebounded swiftly and rallied to a 16-month high of 1,600.2 in September 2014. This resiliency of Thai stock market was attributed to strong fundamentals, the strength of Thai listed companies and a deep and diversified market. At the end of 2014, SET closed at 1,497.67, up by 15.32 percent from the end of 2013 (SET, 2014).

The Market for Alternative Investment (MAI) The MAI was established in 1992 under the Securities and Exchange Act but did not begin operations until June 1999. Its purpose is to create new fund-raising opportunities for innovative businesses with high potential growth whose size may be too small to list in the SET. The MAI focuses on businesses with registered capital between 20 - 300 million baht. As of 23 March 2009, the MAI has 52 listed companies with total market value of 23 billion baht. In addition, the Thai stock market benefited from accommodative monetary policy in Europe and quantitative easing in Japan. In the last quarter of 2014, concerns over global economic slowdown and plummeting oil prices again dragged the market lower. At the end of 2014, MAI closed at 700.05, up by 96.20 percent from the end of 2013 (SET, 2014).

The Bond Electronic Exchange (BEX) BEX was launched by the Stock Exchange of Thailand in November 2003 to support the development of Thailand's secondary bond market and expand bond activities to smaller investors. Bonds tradable on the

exchange include government bonds, corporate bonds and Asian Bonds.

In Thailand, most bonds trade off-exchange and trading activities are reported to the Thai Bond Market Association (TBMA, previously named the Thai Bond Dealing Centre). By trading through BEX, investors know the exact current market price and volume of the last trade because all trades are entered into the electronic trading platform; and counterparty default risks are eliminated because all trades that go through BEX are guaranteed by Thailand Securities Depository, Ltd. (TSD) which acts as the counterparty for all trades. As of December 31, 2014, there were 502 companies listed on SET and 111 on MAI along side with 569 bond products listed on BEX (SET, 2014).

The Thai Futures Exchange (TFEX) The Thailand Futures Exchange Plc (TFEX) is a derivatives exchange that was established in May 2004 as a subsidiary of The Stock Exchange of Thailand (SET). TFEX is governed by the Derivatives Act B.E. 2546 (2003) and is under the supervision of the Securities and Exchange Commission (SEC). The Thai derivatives market has a reliable trading infrastructure, and TFEX ensures a fair, orderly and transparent market. TFEX offers a cost-efficient and comprehensive range of services including order entry facilities, a matching system and market dissemination system through a reliable electronic trading platform. Products traded on the exchange include SET50 index futures, stock options, stock futures, and gold futures, with SET50 index futures and gold futures being the most popular.

Thailand Futures Exchange pcl (TFEX) has increased operational efficiency,

improved product quality and upgraded service excellence in many aspects, aiming to better facilitate trading among investors and to ensure broader applications. TFEX has adjusted its trading and clearing systems on the same platform as the current SET CONNECT for equity instruments. This single platform will support the formulation of trading strategies that integrate trading transactions of derivatives and equity instruments. It will also enable faster, more convenient and more efficient development of new financial products and instruments. Furthermore, in 2014 TFEX expanded the afternoon trading period, making 15 minutes earlier than the normal trading time (SET, 2014).

1.3 Aims and Objectives of the Study

The aim of this research is to empirically examine whether a lead-lag relationship exists between Spot and Futures Market in Thailand and to attempt to identify profitable trading strategies via the use of the spot and futures markets in Thailand based on Error-Correction[10] and the Cost of Carry Model. It is expected that the findings of this paper will identify the effect of the futures index contract in the Thai market and whether it can be used as a hedging instrument or price discovery tool. The lead-lag relationship of futures and spot index reflects how fast one market reflects new information relative to the other and how well it is linked. This research will examine whether the spot and futures index changes are predictable or not by using advanced econometric methodology. Moreover, this research focuses on the

[10] Error correction models (ECM) have been studied actively in economics and there are numerous examples of their application, which include classical error correction model (ECM), which was popularized by Engle and Granger (1987), Granger et al.'s (1993) smooth transition ECM, Balke and Fomby's (1997) threshold cointegration, Markov switching ECM developed by Spagnolo, Sola, and Psaradakis (2004) and reviews by Granger (2001).

trading behavior of various investor types in the Stock Exchange of Thailand (SET) and Thailand's Derivative Market in the aspects of their trading patterns and sources of trade performance.

The objectives of the research are:

1. To examine whether there is a relationship between Spot and Futures Market.
2. To find the direction of the relationship if one exists.
3. To examine whether a profitable trading strategy exists between these two markets.
4. To investigate trading patterns of foreign investors, institutional investors, and individual investors in both Spot and Futures Market.
5. To investigate and compare trade performance of the investor by decomposing trade performance into two sources; trading price spreads, and market timing.

1.4 Statement of Problem/ Research Question

This research examines whether spot and futures index changes are predictable or not. The study employs advanced econometric methodology to examine the lead-lag relationship and to identify profitable trading strategies between the spot and futures market in Thailand. Moreover, this study focuses on the trading behavior of various investor types in Thailand in the aspects of their trading patterns and sources of trade performance.

Research question: Is there any causal relationship between spot and futures price changes in Thailand? And if so, what is the direction of causality? Different types of investors are behaving differently or not? Are the different investor types likely to provide different sources of trade performance?

1.5 Contributions

The aim of this research is to provide empirical evidence on whether there exists a lead-lag relationship between the cash or spot market and the futures market in Thailand. If a lead-lag relationship does exist the study will then attempt to identify a trading strategy to make an abnormal profit by using knowledge of the lead-lag relationship. Moreover, the findings from this paper have important implications, not only for the Thai stock market in particular, but for both spot and futures markets in general, as it provided additional evidence that the momentum and contrarian occur in both spot and futures market. I developed a framework for examining investors trading behavior in terms of separating investors into three groups and focusing on both spot and futures market. Furthermore, I have sufficient data to determine the behavior of each type of investors and the data was collected from Stock Exchange of Thailand and Thailand's derivative market that has high quality and reliability.

1.6 Structure of the Study

Chapter one provides introduction and background of this research, aims and objectives, research questions, and contributions.

Chapter two presents the existing theoretical and empirical researches also provides a critical examination of the literature in terms of the theories and models that influence lead-lag relationship and trading behavior between spot and futures market. It is organized around the aims and objectives of this research. It starts by reviewing theoretical framework and consideration and providing comprehensive background knowledge. Then it depicts with the outlining of the important theories and models this literature study is used as a way to frame the research problem within the field. Besides, this chapter explores the link among theories. Literature review provides guidance for this study in terms of theoretical foundation, research direction, objectives and methodologies. Moreover, critical review of existing literature helps identify gaps to be filled in. This chapter discusses in detail in order to provide good understanding on every aspects that related to the research questions.

Chapter three describes the data and methodology employed in this research. It discusses where data have been collected and how the sample has been constructed before turning to the data used in order to test the research question. It presents the data analysis by using various methods. After that, it discusses the methodological approach taken to this research.

Chapter four presents the study analyze the lead-lag relationship between spot and futures market, SET50 index and its futures contracts, for the Thai markets and identifies the profitable trading strategy by using the econometric tools like unit root test and error correction model. Moreover, it presents an in-depth look at the findings of the research and links the results of this study to the previous empirical literatures.

Chapter five investigates investor trading patterns in spot and futures markets in Thailand. The purpose is to empirically examine the existence of momentum and contrarian effects and to investigate the trading patterns of three types of investor, foreign, institutional and individual investors.

Chapter six examines investors' performance and trading sources between spot and futures market. This chapter investigates the performance of each type of investors and the sources of their trading performances.

The final chapter presents the conclusions of this research and summarizes all research findings. This chapter also provides the contribution of this study to the existing literature and identifies possible avenues for further research.

Chapter 2. Literature Review

2.1 Introduction

The literature survey conducted in this research is intended to shed light on those aspects of the literature that are relevant to the overall aim and objectives of this study as well as highlighting the existing gaps in the literature. In order to achieve this the literature survey of this study is carried out in three parts. The first part is intended to provide a background to the research by reviewing some of the relevant literature, theories and models in the fields of the lead-lag relationship, trading strategy and trading behavior in both spot and futures market. The second part of the literature survey is aimed at reviewing and discussing the existing empirical literatures that were undertaken worldwide, and exploring the empirical findings of the previous studies. The third part gives a broad overview of the characteristics of the selected markets to provide the information of the markets involved in this study.

2.2 Theoretical Framework and Consideration

This section reviews the literatures that are intended to sketch the broader picture within which this research is to be seen and refers to a through analysis of the literature related to the theories and the models that influence lead-lag relationship, trading strategy and trading behavior in spot and futures market. By outlining important theories and models this literature review is used as a way to frame the research problem within the field.

2.2.1 Efficient Market Theory

The term 'market efficiency', formalized in the seminal review of Fama (1970), is generally referred to as the informational efficiency of financial markets, which emphasizes the role of information in setting prices. More specifically, the efficient markets hypothesis (EMH) defines an efficient market as one in which new information is quickly and correctly reflected in its current security price. In his first review paper, Fama (1970) outlines the classic taxonomy of information sets available to market participants and further classifies the EMH into the weak-form, semi-strong-form and strong-form. Efficient Market Theory says that in a perfect market where information flow is assumed to be frictionless, the changes in price of stocks or indices and their associated derivative instruments such as options and futures should be instantaneous and simultaneous in response to the arrival of new information.

More recently, Yen and Lee (2008) provide a chronological review of empirical evidence on the EMH over the last five decades. Their survey clearly demonstrates that the EMH no longer enjoys the level of strong support it received during the golden era of the 1960s, but instead has come under relentless attack from the school of behavioural finance in the 1990s. Besides the broad review, there are other survey papers with a specific theme, for instance, Fama (1998) surveys the empirical work on event studies, with a focus on those papers reporting long-term return anomalies of under reactions and over reactions to information; Malkiel (2003) and Schwert (2003) scrutinize those studies reporting evidence of statistically significant predictable patterns in stock returns; Park and Irwin (2007) review the evidence on

the profitability of technical trading rules in a variety of speculative markets, including 66 stock market papers published over the period from 1960 to 2004.

The recent discussion published in Malkiel et al. (2005) clearly indicates that there is no sign of compromise between proponents of the EMH and advocates of behavioural finance. In an attempt to offer reconciliation to the opposing camps, Lo (2004) notes that useful insights can be gained from the biological perspective and calls for an evolutionary alternative to market efficiency.

2.2.2 Cointegration Theory

The concept of cointegrated variables has come to play an important role in much of the time-series econometric work in the last decade. Cointegration is a statistical property of time series variables, which two or more time series are cointegrated if they share a common stochastic drift. Testing for cointegration between variables with unit roots[11] is an integral part of empirical time series analyses. A number of tests are available in the literature. Stock market prices have been examined over the past decades in different ways to determine whether price changes are forecastable or not. These efforts have met with little success. So, there is a technique called cointegration, has been developed, which appears to hold some promise (Ghosh, 1993).

Granger (1981) introduced the concept of cointegration where two variables may move together although they are nonstationary. The rationale behind the concept of

[11] The unit root test is another type of statistical test favoured by researchers in the EMH literature. (See, for example, Dickey and Fuller (1981))

cointegration is that there exists a long-run equilibrium relationship between the two variables. In the short-run they may deviate from each other but market forces, government intervention, etc. will bring them back together. Engle and Granger (1987) extended this concept and showed that cointegrated series have an error correction representation and conversely. With the error correction representation, a proportion of the disequilibrium in one period is expected to be corrected in the next period (Ghosh, 1993).

The well-known tests, suggested by Engle and Granger (1987) is to run a static regression two-step approach and Johansen and Juselius (1990)'s maximum likelihood estimation procedure. A number of papers have used cointegration to study the long-run comovements of time series variables. Cointegrating vectors can be thought of as representing constraints that an economic system imposes on the movement of the variables in the system in the long-run. Consequently, the more cointegrating vectors there are, the more stable the system. (Dickey et al., 1994.) If stock prices are cointegrated, prices in different markets cannot move too far away from each other. In contrast, a lack of cointegration suggests that stock markets have no long-run link and stock prices in different markets can diverge without bound.

2.2.3 Market Efficiency and Cointegration

The concept of applying cointegration to cope with market efficiency is not new and there is a long-lasting discussion regarding the existence of cointegration among commodities, options, bonds, and stock market. More precisely, consider two time series, say X_t and Y_t. Assume that both X_t and Y_t: are non-stationary and need to be

differenced once to induce stationarity. In general, most linear combinations of X_t and Y_t such as $X_t - aY_t = V_t$ are also non-stationary. If first differencing causes X_t and Y_t to be stationary, then V_t also will be stationary after first differencing.

Granger (1986) has demonstrated that market efficiency, in which the price of an asset incorporates all available information, has the important implication that prices from two efficient markets for different assets cannot be cointegrated. Basically, if an asset incorporates all available information, its price change will be unpredictable. The test of market efficiency also focuses on a spot index and futures index, are cointegrated. If they are, with a cointegrating vector of 1, then they cannot drift too far apart because their difference between spot and futures is stationary. However, if the two variables are not cointegrated, so that their difference is non-stationary-say, a random walk then with probability one they will drift infinitely far apart.

The link between cointegration and causality stems from the fact that if spot and futures prices are cointegrated, then causality must exist in at least one direction and possibly in both directions. Cointegration implies that each series can be represented by an error correction model that includes last period's equilibrium error as well as lagged values of the first differences of each variable. Hence, temporal causality can be assessed by examining the statistical significance and relative magnitudes of the error correction coefficients and the coefficients on the lagged variables. The error correction model is expanded by Hasbrouck (1995) applying common-factor model. Such transformation can measure each market's contribution to price discovery, which defined as information sharing percentage on a presumed implicit efficient price. However, the percentage illustration does not provide a definite description

about direction of price discovery process while could not confirm the dominant role. For instance, Roope and Zurbrueg (2002) investigates causality between spots and its futures on the Taiwan stock market. The exogeneity testing results from error correction model showed that there is a bidirectional relationship between these two markets.

2.2.4 Cointegration and the Theoretical Relation between Time Series

Cointegration is a useful method for examining the relationship among financial time series. Engle and Granger (1987) demonstrate that, if a vector of time series is cointegrated, the long- run parameters can be estimated directly without specifying the dynamics because, in statistical terms, the long-run parameter estimates converge to their true values more quickly than those operating on stationary variables. This discovery has accelerated techniques for exploring long-run relationships between time series.

2.2.4.1 Error Correction Model

The dynamic analysis of the cointegration error and stationary variables in the short run is important as the long-run equilibrium for practitioners and policy makers. Of course, such work is possible through the classical error correction model (ECM), which was popularized by Engle and Granger (1987). Error correction models (ECM) have been studied actively in economics and there are numerous examples of

applications, which include smooth transition ECM of Granger et al. (1993), threshold cointegration of Balke and Fomby (1997), Markov switching ECM of Spagnolo, Sola, and Psaradakis (2004) and reviews by Granger (2001). A strand of econometric literature focuses on testing for the presence of nonlinearity and cointegration in an attempt to disentangle the nonstationarity from nonlinearity. A partial list includes Hansen and Seo (2002) and Kapetanios, Shin, and Snell (2006). Time series properties of various ECMs have been established by Corradi, Swanson, and White (2000) and Saikkonen (2005, 2007) among others.

Threshold and smooth transition cointegration models have become popular in applied economic and financial work over the past decade. Examples include, among many others, Swanson (1998), Rothman et al. (2001), and Chen and Wu (2005) who estimated various nonlinear Vector Error Correction Models (VECM) by employing linearity tests that were developed in a stationary univariate setting by Luukonen et al.(1988). Econometric research that investigates extensions of the cointegration theory initiated by Engle and Granger (1987) to smooth transition settings has moved in two main directions. One direction has focused on modeling and testing nonlinear adjustment in deviations from (linear) long-run equilibrium relations. Examples of this approach include Balke and Fomby (1997), Enders and Engle (1998), Hansen and Seo (2002), Bec and Rahbek (2004), and Kapetanios et al.(2006). Another direction of research has involved modeling and testing nonlinearity in cointegrating relations or time series. Examples of this line of research include Caner and Hansen (2001), Chang et al. (2001), Kapetanios et al. (2003), Choi and Saikkonen (2004), Saikkonen and Choi (2004), Gonzalo and Pitarakis (2006), and Kılıc ¸ (2011).

2.2.4.2 Cost of Carry Model

According to the cost of carry valuation, which is the theoretical relation between the price of index futures contract and the price level of the underlying index is,

$$F_t = S_t e^{(r-d)(T-t)}$$

where F_t is the index futures price at time t, S_t is the index price at time t, r-d is the net cost of carrying the underlying stocks in the index, that is, the rate of interest cost r less the rate at which dividend yield accrues to the stock index portfolio holder d. T is the expiration date of the futures contract, so T-t is the time remaining in the futures contract life.

Referring to Stoll & Whaley (1990) and Brook et al. (2001), the market force driving the cost of carry relation is the never-ending search for a free lunch. When the futures price is above the level implied by the right hand side of equation above, a riskless arbitrage profit equal to the different between the futures price and the index price plus the cost of carry, a long arbitrage profit of $F_t - S_t e^{(r-d)(T-t)}$ can be earned by selling the futures contract and buying the stock index portfolio, financing the stock purchase with the riskless borrowings. On the other hand, when the futures price falls below the right hand side of the above equation, a short arbitrage profit of $S_t e^{(r-d)(T-t)} - F_t$ can be earned by buying the futures and selling the portfolio stocks, investing the proceeds of the sale of stock at the riskless rate of interest (Sarno & Valente, 2000).

Moreover, in the presence of market imperfections such as transactions costs, asymmetric information, capital requirements and short-selling restrictions there could be discrepancies between the traded futures price and its theoretical valuation according to the cost-of-carry model. Furthermore, under market imperfections there may be a lead-lag relationship between spot and futures returns, as well as between volatilities. This way, there is a wealth of studies showing empirical evidence for the main stock index futures markets supporting the existence of lead-lag relationship between spot and futures returns, as well as between volatilities (see, for example, Stoll & Whaley (1990), Wahab & Lasghari (1993), Pizzi et al. (1998), and Racine & Ackert (2000)). Under lead-lag relationships, it is possible to anticipate price movements and the risk level in one market from past information in the other market, a relevant question when using the futures contract as a hedge instrument for risky stock portfolios (Racine & Ackert, 2000).

2.2.5 Price Discovery and Spot-Futures Market Interaction

If the respective markets are free of impediments and are informationally efficient, the returns on a spot market index and the associated futures contract should be perfectly and contemporaneously correlated and not cross- correlated through time; that is, the prices of the stock index and the futures simultaneously reflect new information as it hits the market. This constraint is intuitive since otherwise arbitrage opportunities would abound. The efficient market hypothesis implies that any mispricing that arises, and associated arbitrage opportunities, should rapidly be eliminated (Samadi et al., 2011).

In an efficient market, information processing should be expeditious and the most efficient market should lead the others. Hence, information transmission or price discovery is one of the indications of the relative market efficiencies of related assets. Therefore, it is interesting to study about the price discovery (Bhatia, 2007). A wealth of literature exists that analyzes the theoretical relationship between futures contracts and their underlying spot indices. Most studies report that there is a lead-lag relationship. There exist diversified theoretical arguments pertaining to the causal relationship between spot and futures markets by information dissemination and raises the major question that which market price reacts first (lead) whether (a) futures prices tend to influence spot prices or (b) spot prices tend to lead futures prices or (c) a bidirectional feedback relationship exists between spot and futures prices.

2.2.5.1 Futures Prices Tend To Influence Spot Prices

The main arguments in favour of futures market leads spot market are mainly due to the advantages provided by the futures market includes higher liquidity, lower transaction costs, lower margins, ease leverage positions, rapid execution and greater flexibility for short positions. Such advantages attract larger informed traders and make the futures market to react first when market- wide information or major stock-specific information arrives. Thus, the future prices lead the spot market prices. Besides, as stated in Chaihetphon & Pavabutr (2010) that the most common explanation why a lead–lag relationship between the two markets is observed is that it is less costly for traders to exploit information in the futures market since transaction cost is lower and the degree of leverage attainable is higher. A lead in the

futures prices implies that price is being discovered first in that market

2.2.5.2 Spot Prices Tend To Lead Futures Prices

On the other hand, the low cost contingent strategies and high degree of leverage benefits in futures market attracts larger speculative traders from a spot market to a more regulated futures market segments. Hence, this ultimately reduces informational asymmetries of the spot market through reducing the amount of noise trading and helps in price discovery, improve the overall market depth, enhance market efficiency and increase market liquidity. This makes spot market to react first when market-wide information or major stock- specific information arrives. Hence, spot market leads the futures market. Besides, referring to Cabrera et al. (2009), Chen & Gau (2009), and Yang et al. (2012), they found that the cash market leads the futures market and the cash market dominates the futures market in price discovery. This is perhaps not too surprising, given the fact that many domestic individual investors and foreign investors were practically prevented from trading in the futures markets by the stringent regulations, and such high barriers to entry reduces the information content of the futures prices and thus the emerging futures market's price discovery performance.

2.2.5.3 Bidirectional Feedback Relationship Exists between Spot and Futures Prices

Besides, there exists a bidirectional relationship between the futures and spot markets through price discovery process (see, Turkington and Walsh 1999; Chris, Alistar and

Stuart 2001; Ryoo and Graham Smith 2004; Kenourgios 2004 and Chang and Lee 2008). This may be mainly due to future markets attracts larger informed traders to enjoy the advantages of higher liquidity, lower transaction costs, lower margins and greater flexibility for short positions. Hence, these advantages make futures markets to lead the spot markets around macro-economic or major stock-specific information releases. Consequently, the spot markets will lead the futures market under the circumstances that these advantages of futures markets attracts larger speculative traders from a spot market and reduces informational asymmetries of the spot market through reducing the amount of noise trading and helps in price discovery, improve the overall market depth, enhance market efficiency and increase market liquidity. This makes spot market to react fast when market-wide information or major stock-specific information arrives. Thus, both the spot and futures markets are said to be informationally efficient and reacts more quickly to each other.

2.2.6 Investor Trading Behavior

There is an ongoing debate whether investors trading decisions are influenced more by information about value or by psychological biases. Two categories of theoretical trading models have been developed to explain the two potential influences of behavior.

2.2.6.1 The Information-Based Trading

The information-based category of models posits that trading is based on informational advantages. These models suggest that informed investor trading

would exhibit a positive feedback, or momentum, pattern of trading. That is, high (low) returns in one period will be associated with a high degree of investor buying (selling) in the next period. This herding pattern is the result of a group of investors trading on the same (or correlated) information signals (see Bikhchandani et al., 1992; Hirshleifer et al., 1994).

2.2.6.2 The Behavioral-Based Trading

The behavioral-based models posit that investor decisions are influenced by cognitive errors such as overconfidence and disposition effect. These behavioral models (see Daniel et al., 1998; Gervais and Odean, 2001) also suggest that a positive feedback trading pattern can be indicative of investor overconfidence. Therefore, both information-based and behavioral-based theories predict that investors may engage in positive feed- back trading.

2.2.7 Momentum and Contrarian

Empirical evidence that appears to contradict the efficient market hypothesis has recently spurred the development of what has come to be known as behavioral finance. Theories of investor under- and overreaction to news are put forward to explain return patterns such as momentum and contrarian. There is an ongoing debate as to whether investor-trading decisions are influenced more by information related to value or by psychological biases.

Two categories of theoretical trading models have been developed to explain the two potential influences of behavior as discussed in Kamesaka et al. (2003). The information-based category of models posits that trading is based on informational advantages. These models suggest that informed investor trading would exhibit a positive feedback, or momentum, pattern of trading. That is, high (low) returns in one period will be associated with a high degree of investor buying (selling) in the next period. The behavioral-based models posit that investor decisions are influenced by cognitive errors such as overconfidence and disposition effect. A contrarian strategy, or value investing, would manifest itself as a negative feedback pattern. That is, after stock prices decline and become cheap relative to value, value investors buy. Therefore, a negative return is followed by investor buying, which is called negative feedback trading. Lastly, investors may trade using strategies that are not associated with past market returns, such as indexing or trades based on liquidity needs.

The assumptions behind these theories of investor behavior are founded in psychological research. However, this line of research could benefit from a more complete picture of how investors actually behave and how they differ from one another in the way they react to the same information, Grinblatt and Keloharju (2000). A number of recent empirical studies have investigated the trading behavior of different investor types; foreign, institutional, and individual investors. For instance, Odean (1998, 1999) finds contrarian tendency of individual investors' behavior in the U.S., Nofsinger and Sias (1999) find the trading behavior of U.S. institutional investors follow momentum trading patterns, Choe et al. (1999) investigate daily trading patterns and herding behavior in Korea. Grinblatt and

Keloharju (2000) examine investment strategies of different investor types in Finland and find individuals and institutions follow contrarian trading strategies while foreigners follow momentum investment strategies.

2.2.8 Investor Trading Performance

Investors with varying degrees of experience in an activity succumb to cognitive biases at different levels. One might think, for instance, that accumulated experience reduces the tendency to commit cognitive errors. However, some researchers believe that certain behavioral biases, like overconfidence, may actually be exacerbated with experience. Take, for example, the stock market environment where the level of predictability is very low. Here, experts may even be more prone to overconfidence than novices because they have theories and models with which they may tend to overweigh. Camerer and Johnson (1997) refer to the failure of experts in making accurate predictions as a process-performance paradox. Another mechanism that may cause experience to increase overconfidence is through having experienced some success (Wolosin, Sherman, and Till, 1973). Gervais and Odean (2001) present a model in which investors learn to be overconfident because they experience a bull market. Thus, those investors who have been investing through a bull market are predicted to exhibit more overconfident characteristics than new investors. In this way, more sophisticated investors (those with experience) may suffer from cognitive biases at a stronger level than less sophisticated investors. However, more experience with non-bull market environments will ultimately reduce overconfidence.

2.2.8.1 Behavioral Biases and Investor Performance

Investors may be inclined toward various types of behavioral biases, which lead them to make cognitive errors. People may make predictable, non-optimal, choices when faced with difficult and uncertain decisions because of heuristic simplification (Hirshleifer, 2001). Heuristic simplification exists because constraints on cognitive resources like memory, attention, and processing power force the brain to shortcut complex analyses.

2.2.8.1.1 Overconfidence Traits

In the micro-foundations of behavioral finance, DeBondt and Thaler (1995) stated that "perhaps the most robust finding in the psychology of judgments is that people are overconfident." Overconfidence is therefore one of the most common human characteristics. It reflects the very prevalent tendency for people to overestimate their own abilities, their own prospects for success, the probability of positive outcomes, the ac- curacy of their own knowledge, and to perceive them- selves more favorably than they perceive others.

Overconfidence manifests itself in many different ways, such as the tendency to overestimate the accuracy of one's own information or miscalibration (Biais, Hilton, Mazurier, and Pouget, 2002). In a financial market context with asymmetric information, Benos (1998), Odean (1998), and Daniel, Hirshleifer, and Subrahmanyam (1998) show theoretically that miscalibration leads to excessively aggressive trading strategies and poor performance. The best-established finding in

the calibration literature is that people tend to be overconfident when answering questions of moderate to extreme difficulty (Fischhoff, Slovic, and Lichtenstein (1977), Yates (1990), Griffin and Tversky (1992)), and underconfident when answering easy questions. They also tend to be well calibrated when predictability is high, and when performing repetitive tasks with fast, clear feedback.

Investors who are overconfident believe they can obtain large returns, thus they trade often and they underestimate the associated risks (Benos, 1998; DeLong et al., 1990; Kyle & Wang, 1997; Odean, 1998; Wang, 2001). Empirical evidence finds support for this theory. Barber and Odean (2000, 2001) and Odean (1999) find that individual investors trade excessively, expose themselves to a high level of risk, and make poor ex post investing decisions. Odean (1999) finds that stocks that individuals sell outperform stocks that they buy.

Overconfidence can also take the form of overestimating one's own abilities relative to others, also known as the "better than average" effect (Taylor and Brown, 1988). This can lead to unrealistic positive self-evaluations (Weinstein, 1980). Camerer and Lovallo (1999) describe the better than average effect as "competitive blind spots." Decision makers fail to appreciate their competitors' abilities and often over-confidently think that they will succeed while others will fail.

2.2.8.1.2 Disposition Effect

Another form of heuristic simplification is mental accounting, where the mind keeps track of gains and losses related to decisions (Thaler, 1980). According to Hirshleifer

(2001), mental accounting may explain the "disposition effect." Simply stated, people want their good decisions to be recognized immediately in their mental accounts, but they postpone acknowledging their bad decisions. This behavioral bias has implications for investing behavior. That is, investors may sell stocks that have increased in price or one that have decreased in price. At the same time, investors may hold on to their poorly performing stocks because they are not ready to acknowledge that they made a mistake, and because they are afraid that the stocks may recover (i.e., they wish to avoid regret) (Shefrin and Statman, 1985). Odean (1998) finds empirical support, he finds that U.S. individual investors are more willing to sell stocks that have done well than those stocks that have done poorly. Frazzini (2006) empirically tests the model and concludes that when investors display the disposition effect, it induces a stock price underreaction to news announcements and a post-announcement price drift.

2.3 Empirical Literatures

This part reviews the significant findings from earlier relevant research on the lead-lag relationship, trading strategy and trading behavior in spot and futures market. The purpose of this review is twofold. The first is to identify the gap in the literature, which this research aspires to fill and the second is, by undertaking a critical review of the analytical techniques and research designs used, to establish the appropriate research methodology to be used in the present research. The review is split into three parts: the relationship between spot and futures market, the trading patterns of various investor types, and the trading performance of different types of investors.

2.3.1 Empirical Studies Examining the Relationship between Spot and Futures Market

In theory, since both futures and spot prices reflect the same aggregate value of the underlying asset and considering that instantaneous arbitrage is possible, futures should neither lead nor lag the spot price. However, the empirical evidence is diverse, although the majority of studies indicate that futures influence spot prices but not vice versa. The usual rationalization of this result is that the futures prices respond to new information more quickly than spot prices, due to lower transaction costs and flexibility of short selling.

Table 2-1: Empirical studies examining the relationship between spot and futures market.

Author (s)	Country	Market	Methods	Period	Results
Kaweller et al. (1987)	United State	Index Spot and Futures Market	Three-stage least-squares regression	March 1984 – December 1985	Futures Lead Spot
Ghosh (1993)	United State	Index Spot and Futures Market	Cointegration and Error Correction Models	January 1988 – December 1998	Futures Lead Spot
Tse (1995)	Japan	Index Spot and Futures Market	Cointegration and Error Correction Models	December 1988 - April 1993	Futures Lead Spot
Iihara et al. (1996)	Japan	Index Spot and Futures Market	AR(1) Model and Bivariate GARCH(1,1)	March 1989 - February 1991	Futures Lead Spot
Shy et al. (1996)	France	Cash Indices and Futures Market	Cointegration and Error Correction Models	August 1994 - September 1994	Futures Lead Spot
Pizzi et al. (1998)	United State	Index Spot and Futures Market	Cointegration and Error Correction	January 1987 - March	Bi-Directional Causality

			Models	1987	
Brook et al. (2001)	United Kingdom	Index Spot and Futures Market	Cointegration and Error Correction Models	June 1996 - June 1997	Futures Lead Spot
Roope and Zurbrueg (2002)	Singapore and Taiwan	Index Spot and Futures Market	Exogeneity test, Gonzalo and Granger, and Hasbrouck Information Shares	January 1999 – June 1999	Bi-Directional Causality
Kavussanos et al. (2003)	Greece	Spot and Futures Prices	Cointegration and Vector Error Correction Models	August 1988 - April 1998	Futures Lead Spot
So and Tse (2004)	Hong Kong	Index Spot, Futures and the Tracker Fund	Hasbrouck, Gonzalo, Granger common-factor models and the M-GARGH	November 1999 - June 2002	Futures Lead Spot

			model.		
Kang et al. (2006)	Korea	Index Spot, Futures and Options market	OLS Regression	October 2001 - December 2002	Futures and Options Lead Spot
Lucian (2008)	Romania	Cash Indices and Futures Market	Top-down and Bottom-up Approach	August 2007 - March 2008	Cash Leads Futures
Bohl, et al. (2009)	Poland	Index Spot and Futures Market	Markov-Switching-GARCH	April 2005 - December 2007	Spot Leads Futures
Cabrera et al. (2009)	European Countries and Japan	Foreign Exchange Spot and Futures Markets	Exogeneity test, Gonzalo and Granger, and Hasbrouck Information Shares	November 1994 - July 2005	Spot Leads Futures
Chen and Gau (2009)	Taiwan	Index Spot, Futures and Options market	Hasbrouck Information Shares	November 2004 - June 2005	Spot Leads Futures

Norden and Weber (2009)	European Countries	Stock, Bonds and CDS Markets	Three-Dimentional VAR Model	January 2000 - December 2002	Stock Leads Bonds and CDS
Jackline and Deo (2011)	India	Commodity Spot and Futures Market	Pair-Wise Granger Causality Test	January 2001 - May 2010	Bi-Directional Causality
Yang et al. (2012)	China	Index Spot and Futures Market	Cointegration and Asymmetric ECM-GARCH Model	April 2010 - July 2010	Bi-Directional Causality
Chen (2014)	United State	Index Spot and Futures Market	Pair T-Test	August 2011 - December 2011	Futures Lead Spot
Zhou et al. (2014)	China	Index Spot and Futures Market	VAR and TVP-VAR model	August 2010 - June 2013	Bi-Directional Causality
Bhandari and Kamaiah (2015)	India and Three Developed Countries	Indian Stock Prices and Four Stock	Cross-Spectral Method	January 2000 - December 2010	No Causality

		Indices From Developed Countries			

Table 2-1 shows that there are several papers that have investigated whether a lead-lag relationship exists between spot and futures prices. The error-correction model was the most general model to test for the first moment dependencies while the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model was used in order to examine for the higher moment interactions. Not only lead-lag relationship in the futures and spot index but also commodity futures and spot price as in Jackline and Deo (2011), and an foreign exchange spot and futures markets as in Cabrera, Wang and Yang (2009) were investigated.

Earlier empirical analyses focus on whether futures price is a determinant of spot price. The studies find inconsistent evidence and provide some ambiguous interpretations. Using different econometric methods, there are many previous literatures to address that futures significantly tends to lead spot market. However, the studies apply unidirectional econometrical methodology, which means that stock markets have a mild positive predictive ability on futures returns. For instance, Kawaller et al. (1987) utilized the three-stage least-squares regression to examine the price relationship between S&P500 futures and the S&P500 index, they indicate that S&P 500 futures price lead its spot price by 20–45 min while spot prices affect futures prices beyond 1 min. Besides, Finnerty and Park (1987) report that stock

index futures price changes are correlated with the stock index spot price changes. They claim no evidence for a causal relationship. Stoll and Whaley (1990) employs a standard time series analysis to research on the relationship between S&P 500 and Major Market Index (MMI) index futures returns. They conclude that S&P 500 and MMI index futures returns lead stock index returns by above 5 min on average. Also, they demonstrate that spot returns lead futures returns in the early inception period of futures trading. The standard time series analysis, however, fails to deal with short-run and long-run problem which is a crucial topic on equilibrium relationship based on arbitrage activities.

By employing traditional error correction model, the existence of cointegration among time series of variables or the number of cointegrating vectors (linear combinations of variable which stabilize the system) does not help clarifying how an endogenous variable is driven by exogenous ones. Therefore, as reference above, earlier studies cannot have the same implication of the unidirectional price discovery process which will be able to represent a more precise specification of lead-lag effect.

Ghosh (1993) examined whether the index spot and futures price changes were predictable or not using a cointegration methodology and the error correction model (ECM). He conducted a research by considering at two indices, which are S&P 500 index and Commodity Research Bureau (CRB) index, and their futures prices. The evidence appeared to suggest that futures lead spot index for S&P 500 index and spot lead futures for CRB index. Tse (1995) studied the lead-lag relationship between spot index and futures price of the Nikkei Stock Average (NSA) employing daily

observations. He investigated through this issue by using the error correction model and found that lagged changes in futures price affect the short-term adjustment in the spot index, but not vice versa. Then, he also constructed the model based on different long-run equilibrium equation to find out which model can be the best forecasting model. The result showed that it was an ECM which applied cost-of-carry model to be a long-run relationship that generate better outcome.

Iihara, Kato, and Tokunaga (1996) also revealed in their research that the futures returns strongly lead cash returns using the intraday data of the NSA index and NSA index futures. They divided their data into three periods based on the trend of that period (bull and bear market) and the introduction of the new regulations. Even though there was a lead effect from futures to spot index in all three periods, but in the period when new regulations launched the lead effect was not as high as the first and the second period. Shyy, Vijayraghavan and Quinn (1996) investigated the lead-lag relationship between Cotation Assistee en Continuo or Continuous Assisted Quotation (CAC) index futures and the cash index. By the application of an error-correction model to the minute-by-minute transaction price data, they found that CAC futures lead its cash index. However, it was found that CAC cash index lead the futures when the mid-quote points of bid-ask prices were used.

Pizzi et al. (1998) examined the relationship between the S&P 500 stock index and the three-month and six-month expired futures contract over the same time period using minute-by-minute data. The result projected that there was a bi-directional causality but the futures market tend to have a stronger lead effect. As an extension to the paper examining the lead-lag relationship between spot and futures price, there

is a paper encourage itself to find a profitable trading strategy based on this link by using a time series model, Brook et al. (2001) investigated the lead-lag relationship between the FTSE 100 index and its futures price by using 10-min observations then employing a number of time series models and trading strategies to find whether they could outperform the market. Using ten-minutely observations from 1996 to 1997, they found that lagged changes in the futures price could help to predict changes in the spot price. Their findings also suggested that ECM, which applied cost-of-carry model was the most predictive ability model. However, this model is unable to outperform the benchmark (buy-and-hold strategy) after considering transaction costs.

Roope and Zurbrueg (2002) focused on the increasing competition between exchanges for listing similar index futures contracts and the impact this has on information dissemination between various markets. Specifically, using both the Hasbrouck and Gonzalo–Granger methodologies for extracting the information content held in each market, a comparison of information efficiencies between the Singapore Exchange and the Taiwan Futures Exchange is examined for Taiwan Index Futures listed in both markets. The results show not only a common stochastic trend between index futures and their underlying indices, but also provide strong evidence to suggest price discovery primarily originates from the Singapore futures market. There are direct implications of this result for both financial exchanges and traders in particular, that traders realize price determination can arise from both futures markets, and the need for exchanges to maintain a reputation as an information center for these similarly traded financial instruments.

Kavussanos et al. (2003) investigated the causal relationship between futures and spot prices in the freight futures market. Being a thinly traded market whose underlying asset is a service, sets it apart from other markets investigated so far in the literature. Causality tests, generalised impulse response analysis and forecasting performance evaluation indicate that futures prices tend to discover new information more rapidly than spot prices, which is in line with the empirical evidence from other markets. Subperiod results, corresponding to revisions in the composition of the underlying index, show that the price discovery role of futures prices has strengthened as a result of the more homogeneous composition of the index in the recent years. This also indicates that the restructuring of the underlying index in November 1999, to reflect trade flows, which are homogeneous in terms of commodities and cargo sizes, may have a beneficial impact on the market.

So and Tse (2004) investigated the price discovery among the Hang Seng Index market using the Hasbrouck (1995) and Gonzalo and Granger (1995) common-factor models and the multivariate generalized autoregressive conditional heteroskedasticity (M-GARCH) model. The minute-by-minute data from the Hang Seng index, Hang Seng index futures and the tracker fund (ETF) presented the result that their movements are interrelated. The futures markets contain the most information, followed by the spot market. The tracker fund does not contribute to the price discovery process. Their findings also showed that the futures market was the main driving force in the price discovery process, followed by the index. Overall results suggest that the three markets have different degrees of information processing abilities, although they are governed by the same set of macroeconomic fundamentals.

Kang et al. (2006) empirically examined the lead-lag relations among the KOSPI200 spot market, the KOSPI200 futures market, and the KOSPI200 options market, and provides some explanations for the observed lead-lag relations. In general, the KOSPI200 futures and options markets lead the KOSPI200 spot market by up to 10 minutes in terms of returns and by 5 minutes in terms of volatilities, even after purging the infrequent trading effect as well as the bid-ask spread effect. The KOSPI200 options market leads and lags the KOSPI200 futures market by 5 minutes only in terms of returns. The observed lead-lag relations seem to be caused by the difference in transaction costs of the three markets.

Lucian (2008) examined the way price discovery works in the Romanian markets and at the same time explained its most obvious mechanisms by focusing on both cash and futures markets. When new information emerges, it is integrated in the two markets with different speeds, depending upon the characteristics of the markets and the investors involved. This paper discovered and explained the relation by using two different approaches, which are top-down and bottom-up. The data series used are high frequency observations of the instantaneous return rates for two listed market funds (SIF2 and SIF5) along with their futures contracts (DSIF2 and DSIF5); the traded volumes are also inputs. The results show that, in opposition to US markets results, the Romanian cash market leads the futures market by three to five minutes.

Bohl et al. (2009) investigated the impact of introducing index futures trading on the volatility of the underlying stock market. They exploit a unique institutional setting in which presumably uninformed individuals are the dominant trader type in the futures markets. This enables them to investigate the destabilization hypothesis more

accurately than previous studies do and to provide evidence for or against the influence of individuals trading in index futures on spot market volatility. To overcome econometric shortcomings of the existing literature, they employed a Markov-switching-GARCH approach to endogenously identify distinct volatility regimes. the empirical evidence for Poland surprisingly suggests that the introduction of index futures trading does not destabilize the spot market. This finding is robust across 3 stock market indices and is corroborated by further analysis of a control group.

Cabrera et al. (2009) conducted a research by using intra-day data for examining the contribution to the price discovery of Euro and Japanese Yen exchange rates in three foreign exchange markets based on electronic trading systems: the CME GLOBEX regular futures, E-mini futures, and the EBS interdealer spot market during November 1994 to July 2005. They found that the spot market lead the price discovery process for both currencies during the sample period. Chen and Gau (2009) studied the competition in price discovery between markets of index futures, index options, and spot index in the Taiwan Stock Exchange. They investigated how the information transmission between futures prices, options prices, and index levels is affected as the minimum tick size is reduced in the stock market and found that the results do not support the leverage hypothesis that the futures dominate the spot index in price discovery. It may be due to specific regulations of position limits for foreign institutional investor in Taiwan's futures market.

Norden and Weber (2009) analyzed the empirical relationship between credit default swap, bond and stock markets during the period January 2000 to December 2002.

They focused on the intertemporal co-movement by examining weekly and daily lead-lag relationships in a vector autoregressive model and the adjustment between markets caused by cointegration. First, they found that stock returns lead CDS and bond spread changes. Second, CDS spread changes Granger cause bond spread changes for a higher number of firms than vice versa. Third, the CDS market is significantly more sensitive to the stock market than the bond market and the magnitude of this sensitivity increases when credit quality becomes worse. Finally, the CDS market plays a more important role for price discovery than the corporate bond market.

Jackline and Deo (2011) studied the relationship between the futures market and spot market for the lean hogs and pork bellies markets during the sample period January 2001 through May 2010 and quantifies the price discovery function of commodity futures prices in relation to spot prices of the sample markets. The econometric tools like Unit root tests and Pairwise Granger Causality tests were employed in the study. The Augmented Dickey Fuller tests and Phillips-Pearson tests employed in the study proved that both the selected markets were stationary series and the Granger Causality test proved bi-causality relationships among these markets. Hence, it was concluded that the profitable arbitrage does not exist in both of these markets and they are said to be in perfect equilibrium. Besides, Bohl et al. (2011) find that causality between spot and futures market is strongly affected by investor structure in these two markets: the market with more institutional traders will lead the other market. As derivative markets are dominated by large traders, futures prices may lead spot prices—or, it is said that futures markets have a price-discovery function. Price-discovery functions are detected in a number of commodity and financial

markets (see, e.g. Brenner & Kronner, 1995; Chow, 2001; Stoll & Whaley, 1990).

Yang et al. (2012) investigated intraday price discovery and volatility transmission between the Chinese stock index and the newly established stock index futures markets in China. Although the Chinese stock index started a sharp decline immediately after the stock index futures were introduced, the cash market is found to play a more dominant role in the price discovery process. The new stock index futures market does not function well in its price discovery performance at its infancy stage, apparently due to high barriers to entry into this emerging futures market. Based on a newly proposed theoretically consistent asymmetric GARCH model, the results uncover strong bidirectional dependence in the intraday volatility of both markets.

Chen (2014) studied the return volatility movements in S&P 500 spot index and index futures markets, the lead/lag relationship between two markets, and the effect of volatility on the trading costs using year 2011 intraday data. The analyses of intraday data show the following results during the higher volatility period (8/3/2011–12/30/2011). First, the difference of return variances between index futures and spot index is even greater than that during the lower volatility period. Second, the index futures market leads the spot index market and the interaction between both markets becomes stronger. Third, both index futures and spot index exhibit clearer U-shape intraday pattern of return volatilities. Finally, the trading costs, measured by the bid-ask spreads, are significantly larger.

Zhou et al. (2014) examined the volatility spillover effects between futures market and spot market in China, using both VAR model and TVP-VAR model. This study found strong bi-directional volatility spillovers between CSI futures and spot markets, and the change of futures' volatility decreased the change of spot market's volatility. This results support the hypothesis that the risk management function of the futures market could calm the whole market when new shock comes. The empirical results show that the influence of futures market on spot market enlarged as time passed especially at the third quarter of 2011. After that, the relationship became stable.

Bhandari and Kamaiah (2015) examined the relationship between BSE Sensex and three other developed markets in the frequency domain. Cross-spectral methods, which are important in discovering and interpreting the relationships between economic variables, are used to analyze the relationships between different price series. The results show no significant co-movement of Indian stock prices with developed market prices.

2.3.2 Empirical Studies Considering the Trading Patterns of Various Investor Types

There are numerous existing empirical works that investigate trading patterns of various investor types in international equity markets. Recent empirical studies have found that different investor types follow different trading patterns.

Table 2-2: Empirical studies considering the trading patterns of various investor types.

Author (s)	**Country**	**Investor type**	**Methods**	**Period**	**Results**
Lakonishok et al. (1992)	U.S.	Institutional Investors	Dratio and Nratio	for the period of 1985-1989	Momentum Trading
Brennan and Cao (1997)	U.S.	Foreign Investors	International Equity Portfolio Investment Flows Model	for the period of 1982-1994	Momentum Trading
Odean (1998)	U.S.	Individual Investors	Proportion of Gains and Losses Realized	January 1987 - December 1993	Contrarian Trading
Choe et al. (1999)	Korea	Foreign Investors	Equally-Weighted Averages of the Normalized Price-Setting Order Imbalance Stocks	from November 30, 1996 to the end of 1997	Momentum Trading

Nofsinger and Sias (1999)	U.S.	Institutional Investors	Average Annual Cross-Sectional Mean Abnormal Return	for the period of 1977-1996	Momentum Trading
Grinblatt and Keloharju (2000)	Finland	All types of Investors	Buy Ratio and the Binomial Test	for the period of 1994-1996	Foreign Investors are Momentum Traders, Individual and Institutional Investors are Contrarian Traders
Dhar and Kumar (2001)	U.S.	All types of Investors	Average Trend Before Buys and Average Trend Before Sells	for the period of 1991-1996	Mixed Results
Goetzmann and Massa	U.S.	Index Fund Investors	Binomial Test of the	over the years	Mixed Results

(2002)			Differences in Proportion Applied to Investment Flows and Market Return and VAR Model	1997 and 1998	
Kang et al. (2002)	China	Investors Who Trade on "A" Shares	Equal-Weighted Portfolio Strategies and Value-Weighted Average Return	January 1993 - January 2000	Short-Horizon Contrarian and Intermediate-Horizon Momentum Strategies
Karolyi (2002)	Japan	All Types of Investors	Net Seller/Buyer and VAR Method	for the period of 1975-January 1995	Foreign Investors are Momentum Traders, Individual and Institutional Investors are Contrarian

					Traders
Griffin et al. (2003)	U.S.	Institutional and Individual Investors	Buy and Sell Imbalance and VAR Method	from May 1, 2000 to February 28, 2001	Institutional Investors are Momentum Traders, Individual Investors are Contrarian Traders
Kamesaka et al. (2003)	Japan	All types of Investors	Net Investment Flows and VAR Method	January 1980 - October 1997	Foreign Investors are Momentum Traders, Institutional Investors are Contrarian Traders
Lin and Swanson (2003)	Taiwan	Foreign Investors	Net Share Purchases Difference and Net Value Purchases Difference	From December 3, 1996 to end June 11, 2003.	Momentum Trading
Richards	six Asian	Foreign	Regression	January	Momentum

(2005)	emerging equity markets	Investors	and VAR Analysis of the Effect of Returns on Inflows	1999 - September 2002	Trading
Ng and Wu (2007)	China	Individual and Institutional Investors	Fixed Effects (FE) OLS Regression and FE Logit Regression	From 17 April 2001 through 8 August 2002	Individual Investors are Contrarian Traders, Institutional Investors are Momentum Traders
Shyu and Sun (2010)	Taiwan	Institutional Investors	Average Contributions from Following One's Own Trades and Other Trades	from January 1999 - December 2004	Momentum Trading
Li et al. (2010)	China	Investors Who Trade "A" Shares Listed	Equal-Weighted Portfolio and Cross-Sectional	for the period of 1994 - 2007	Contrarian Trading

			Stock Return Regression		
Bae et al. (2011)	Korea	All Types of Investors	Portfolio Formation Returns	January 1996 - December 2002	Foreign and Institutional Investors are Momentum Traders, Individual Investors are Contrarian Traders
De Haan and Kakes (2011)	Netherlands	Institutional Investors	Net Purchases to Revaluations	over the period 1999 - 2005	Contrarian Trading
Aduda et al. (2012)	Kenya	Individual Investors	Descriptive Survey Designs	over the year 2011	Mixed Results
Kaniel et al. (2012)	U.S.	Individual Investors	Net Trading and Cumulative Abnormal Returns	From January 1, 2000 to December 31, 2003	Contrarian Trading
Birru (2015)	U.S.	Individual Investors	Cross-Sectional	From July 1967 to	Intermediate-Horizon

			Regression	December 2011	Momentum Strategies
Hu et al. (2015)	Taiwan	Transactions Data	Vector Auto Regression (VAR) Model	October 2010 to March 2011	Momentum Trading

Lakonishok et al. (1992) presented evidence on the herding and trend-chasing behavior of institutional money managers. They found that there was weak evidence of herding and somewhat stronger evidence of positive feedback trading or momentum for smaller stocks. However, the evidence showed relatively little of either herding or positive feedback trading in the larger stocks, which constitute the bulk of most institutional holdings and trading. There was also no consistent evidence of a significant positive correlation between changes in institutional holdings and contemporaneous excess returns, except again in small stocks. Thus, they concluded that there was no solid evidence in their data that institutional investors destabilize prices of individual stocks. Instead, the emerging image is that institutions follow a broad range of styles and strategies and that their trades offset each other without having a large impact of prices.

Brennan and Cao (1997) focused on the foreign investor who traded in the U.S. market, they developed a model of international equity portfolio flows that relied on informational differences between foreign and domestic investors. They examined U.S. portfolio investment in emerging markets and found a strong evidence that U.S. purchase are positively associated with local market returns in many countries or

they have a positive trading pattern. There is even evidence that this effect persists when they substitute the lagged local market return for the contemporaneous return. Odean (1998) reported that individual investors in U.S. exhibited contrarian behavior and they tended to buy stocks with more extreme performance than those they sell and that they are likely to sell stocks that have performed well in recent weeks.

Choe et al. (1999) examined the impact of foreign investors on stock returns in Korea from November 30, 1996 to the end of 1997 using order and trade data. They found strong evidence of positive feedback trading or momentum and herding by foreign investors before the period of Korea's economic crisis. During the crisis period, herding falls, and positive feedback trading by foreign investors mostly disappears, so they found no evidence that trades by foreign investors had a destabilizing effect on Korea's stock market over the sample period. In particular, the market adjusted quickly and efficiently to large sales by foreign investors, and these sales were not followed by negative abnormal returns.

Nofsinger and Sias (1999) explored how changes in institutional ownership are related to the return or feedback trading and stock return momentum. Their analyses revealed a strong positive relation between annual changes in institutional ownership and returns on average, the decile of stocks experiencing the largest increase in institutional ownership outperforms the decile experiencing the largest decrease by more than thirty one percent per year. Therefore, they suggested that either institutional investor engage in intra-year positive feedback trading to a greater extent than individual investors or institutional investors' herding impacts prices to a greater extent than individual investors' herding. The results show that institutional

investors engage in positive feedback trading, although some evidence found that institutional investors' feedback trading is related to their attraction to certain stock characteristics.

Grinblatt and Keloharju (2000) studied how investment behavior relates to past return by examining whether the buy ratio of past winning stocks exceeds the buy ratio of past losing stocks. If this difference is positive, the buy ratio for past winning stocks exceeds the buy ratio for past losing stocks and the investor category is viewed as momentum-oriented on day t. If it is negative, the investor category is viewed as contrarian on day t. The results show that Finnish household investors tend to be contrarians for all of the ranking periods. The frequency of contrarian behavior in Finland seems to be inversely related to a rough (and admittedly ad hoc) ranking of the sophistication of the investor types. Institutional investors generally take larger positions than individuals, have more resources to expend on research, and in many cases, view investment as a full-time career. Consequently, it is reasonable to view institutions as more sophisticated than individuals. All of the Finnish investor categories are probably less sophisticated than the foreign investors. Foreign investors tend to be well capitalized foreign financial institutions with a long history of successful investment in other stock markets. This category is generally composed of mutual funds, hedge funds, and foreign investment banks. Foreign investors alone tend to be momentum investors over all horizons.

Dhar and Kumar (2001) investigated the trading pattern of different investor type. As having established that there exist a considerable number of investors who systematically trade on trends, then they proceed to identify those investor segments.

Their classification algorithm classifies each investor as momentum or contrarian (or unclassified) using their buy and sell trades separately. They found mixed results, overall, a comparison of the portfolio characteristics and demographics of the identified investor segments reveal no significant differences. However, the trading characteristics of the segments show systematic differences, particularly in their response to reference points such as monthly high and low prices and in their strategies for selling losers. Contrarian buy investors are more likely to buy near monthly low prices while the contrarian sell investors tend to sell near the monthly high prices. The momentum investors do not exhibit such timing behavior. All four investor segments are reluctant to sell losers but the effect is the strongest for contrarian sell investors who expect price reversals and hence show a greater tendency to hold on to the losers. The effect is very weak for momentum sell investors who believe that a downward price trend is likely to continue and hence are more likely to realize their losses.

Goetzmann and Massa (2002) used a two-year panel of individual accounts in an S&P 500 index mutual fund to examine the trading and investment behavior of more than 91 thousand investors who have chosen a low-cost, passively managed vehicle for savings. They got mixed results, they identified positive feedback traders as well as contrarians whose activities are conditional upon preceding day stock market moves. They tested the consistency and profitability of these conditional strategies over time and found that more frequent traders are typically contrarians, while infrequent traders are more typically momentum investors.

Kang et al. (2002) studied the contrarian and momentum strategies in the China stock market during year 1993 to 2000 by using data on ‘‘A’’ shares, accessible only to local investors in China. They found statistically significant abnormal profits for some short-horizon contrarian and intermediate-horizon momentum strategies. Further analysis indicates that overreaction to firm-specific information is the single most important source of short-term contrarian profits, the intermediate-term momentum profits are not, however, distinct due to the dominance of overreaction effect, and the negative cross serial correlation contributes to momentum profits.

Karolyi (2002) examined whether the shift in aggregate foreign portfolio investment activity in Japan exacerbated the effect of the crisis on markets, or whether it simply reflected positive-feedback trading behavior. The data draws from weekly reports to the Tokyo Stock Exchange (TSE) of aggregate purchases and sales of Japanese equities by foreigners and local institutional and individual investors. The results show that there is evidence of consistent positive-feedback trading or momentum before, during and after the Asian crisis among foreign investors, while Japanese banks, financial institutions, investment trusts and companies themselves were aggressive contrarian investors. However, there is no evidence that this trading activity by foreigners destabilized the markets during the crisis.

Griffin et al. (2003) provided interesting cross-sectional evidence on the relation between institutional and individual trading and a stock’s past returns, trading persistence, and return predictability in Nasdaq 100 securities. They illustrated that there is a strong contemporaneous positive (negative) relation between institutional (individual) trading activity and daily stock returns that is primarily due to intra-daily

trades following past returns. This finding of daily and intra-daily trades strongly following past returns and trading persistence is robust to a variety of different trade-size classifications and methodologies.

Kamesaka et al. (2003) investigated investment pattern of investor groups in Japan by using weekly aggregate investment flow. They indicated that foreign investor trade flow is positively correlated with the TOPIX return. The estimates for correlation on past returns are also significantly positive. This suggests that foreign investors are positive feedback, or momentum, traders. While, the trading flow of banks, insurance firms, investment trusts, and companies is all negatively correlated with the current and past market returns. This suggests that these investor groups employ a negative feedback, or contrarian, trading strategy. Individual investor flow is negatively correlated with the TOPIX return during the week of the trading. However, individual investor flow is uncorrelated with past weekly market returns. That is, individual investors do not appear to be market timing feedback traders at least not on a weekly herding period. The evidence for individual investor feedback trading is mixed.

Lin and Swanson (2003) explored trading behavior of foreign investors in 60 large-size firms listed on the Taiwan Stock Exchange. Strong evidence is found that foreign investors employ momentum strategies of buying past winners and selling past losers over time horizons varying from one day to one year and that past returns strongly affect investment decisions of foreign investors in Taiwan. Moreover, foreigners seem to prefer stocks with large market capitalizations, with high book-to-market ratios and in high-tech industries but avoid stocks with a high rate of share

turnover. While no evidence is found that foreign investors herd on market consensus.

Richards (2005) analyzed the aggregate daily trading of all foreign investors in six Asian emerging equity markets. The findings show that foreigner's flows into several markets show positive feedback trading or momentum with respect to global, as well as domestic, equity returns. The nature of this trading suggests it is due to behavioral factors or foreigners extracting information from recent returns, rather than portfolio rebalancing effects. Since foreigners are essentially all institutional investors, this finding presented a strong example of a form of high frequency momentum trading by institutional investors and contrarian trading by individuals.

Ng and Wu (2007) investigated the trading behavior of institutions and individuals in Chinese equity markets from 2001 to 2002. Their paper employed a unique data set to analyze the trading behavior of 4.74 million individual and institutional investors across Mainland China. Results show that groups of individual investors with varying trade values engage in different trading strategies. Chinese institutions are momentum investors, while less wealthy Chinese individual investors at large are contrarian investors. The results also indicate that a small group of wealthiest Chinese individuals tend to behave like institutions when they buy stocks, and behave like less wealthy individuals when they sell. Furthermore, only the trading activities of institutions and of wealthiest individuals can affect future stock volatility, but those of Chinese individual investors at large have no predictive power for future stock returns.

Shyu and Sun (2010) measured the herding behavior of three major institutional investors in Taiwan's stock market, namely foreign institutional investors, domestic mutual–funds investors, and domestic securities dealers. Aside from discussing the overall phenomenon of institutional herding, they also examined the relationships between herding and momentum trading. Overall, the finding presented that institutional herding exists in Taiwan's stock market. However, institutions tend to follow both their own trades and other institutional trades. Furthermore, they found that institutional investors in Taiwan's stock market are momentum traders but given that the regression coefficient between previous-day institutional investors demand and current-day institutional investors demand is little affected after momentum trading is factored in, and that the regression coefficient of previous-day institutional investors' demand is significantly larger than that of previous-day returns. Then, they surmised that momentum trading is not the main reason for the herding behavior of institutional investors.

Li et al. (2010) followed Jegadeesh and Titman's (1993) approach and found some reversal effects where the past winners become losers and past losers become winners afterward. They examined the investors who trade on "A: shares listed in China and found that the contrarian profit is statistically significant for the strategies using short formation and holding periods, especially for the formation period of 1 to 3 months and the holding periods of 1 to 3 months. The contrarian strategies can generate about 12 percent per annum on average. However, there is no evidence of the strategies using longer formation and holding periods. Moreover, they followed Heston and Sadka (2008) to examine where there is any seasonal pattern in the cross-sectional variation of average stock returns in their momentum/contrarian strategies.

The results suggested that there is no seasonal pattern and the results are robust to different formation and holding periods.

Bae et al. (2011) studied the investor behavior in Korea during 1996 to 2002. They found that the trading behavior of investors in the Korean market, in general, foreigners behave like short-term momentum traders pursuing a growth strategy. Local institutions also trade like momentum traders but tend to buy value stocks. In contrast, individual investors trade like contrarians who buy past losers and sell past winners. Their findings showed that foreigners prefer large-cap stocks with high dividends, in contrast, individual investors have a strong preference for small-cap, high-leverage, low dividend paying stocks, whereas local institutions tend to buy small-cap, low leveraged stocks.

De Haan and Kakes (2011) analyzed investment strategies of three types of Dutch institutional investors, which are pension funds, life insurers and non-life insurers, over the period from 1999 to 2005 by using balance sheet and cash flow data, including purchases and sales of equity, fixed income and real estate. Overall, the finding illustrated that all three investor types tend to be contrarian traders, they buy past losers and sell past winners. Especially pension funds showed this behavior in the most turbulent part of the sample implying that these institutions have a stabilizing impact on financial markets when this is needed most. Life insurers tend to be contrarian traders when they have a high proportion of unit-linked policies, while non-life insurers are contrarian when they have a more risky business model.

Aduda et al. (2012) studied the behavior of individual investors in the trading shares of companies listed at the Nairobi Stock Exchange, Kenya. Overall, they found that there were varied behaviors and financial performance of individual investors in Kenya. Some investors exhibited rational behavior in making their investment decisions. This can be seen in investors who decided to go for stocks from companies with good financial performance and dominant niche the stocks market. On the contrary, there were investors who were poised to realize negative results due to irrationality and herding behavior. Despite the fact that most of the investors sampled had sufficient experiences in trading in stocks, the vast majority had not acquired the required knowledge in key to making the best investment decisions.

Kaniel et al. (2012) provided evidence of informed trading by individual investors around earnings announcements using a unique data set of NYSE stocks. They showed that intense aggregate individual investor buying (selling) predicts large positive (negative) abnormal returns on and after earnings announcement dates. They decomposed abnormal returns following the event into information and liquidity provision components, and showed that about half of the returns can be attributed to private information. They also indicated that individuals trade in both return-contrarian and news-contrarian manners after earnings announcements. The latter behavior has the potential to slow the adjustment of prices to earnings news.

Birru (2015) studied the disposition effect and the momentum in U.S. by focusing on individual investors. The results illustrated an intermediate-horizon momentum effect and in the months following stock split, momentum was presented and was unable to be explained by the disposition effect, suggesting that the disposition effect

was not alone in driving momentum. Hu et al. (2015) used intraday data of the Taiwan stock market to present the relationship of investor sentiment to trading frequency and positive-feedback trading, using a VAR model to measure feedback trading in one-minute intervals, they found the existence of positive-feedback trading in the Taiwan stock market, and investor sentiment plays a significant role in explaining positive-feedback trading strategies, particularly in periods of rising market sentiment.

Additionally, to review these works this research would like to present them by classifying the trading pattern of each investor group into three main investor types:

2.3.2.1 Trading Pattern of Foreign Investor

The rapid growth of cross-border equity investment in recent years has generated much interest in the behavior and impact of foreign investors, especially in emerging markets. Foreigners are frequently viewed as influencing prices in these countries and their trading is closely watched. Investors can be positive feedback traders for rational reasons or because of behavioral biases. Investors who pursue portfolio insurance strategies as well as investors with extrapolative expectations are positive feedback traders. Foreign investors may act like positive feedback traders without destabilizing equity markets. One reason is that greater foreign ownership can lead to a lower risk premium for stocks in a country since the risks of these stocks can be better shared internationally.

Most empirical works document that foreign investors follow momentum trading

patterns. For instance Choe et al. (1999), Grinblatt and Keloharju (2000), and Kamesaka et al. (2003) and provide an information based explanation of momentum trading pattern of foreign investors. Similar to Brennan and Cao (1997), who find U.S. equity investment in developed markets is positively related to foreign market return. Froot et al. (2001) find that foreign investors tend to employ momentum trading and that foreign inflows predict positive future returns in local markets, especially in emerging markets. Lin and Swanson (2003) find that foreign investors in Taiwan employ momentum strategies of buying past winners and selling past losers. Richards (2005) employed the regression and Vector Auto Regression analysis also found strong evidence that foreign investors engage in momentum trading in six Asian emerging equity markets, which are the Jakarta Stock Exchange (JSX), Korea Stock Exchange (KSE), Philippine Stock Exchange (PSE), Stock Exchange of Thailand (SET), Taiwan Stock Exchange (TWSE), and Korean Securities Dealers Automated Quotations (Kosdaq) Stock Market.

2.3.2.2 Trading Pattern of Institutional Investor

As institutional investors manage a substantial part of global financial assets, their behavior is likely to have a significant impact on financial market sentiment. In such circumstances, institutional investors may pursue contrarian investment strategies (selling past winners and buying past losers), which are likely to dampen excessive price movements. But they may also behave more like momentum traders (selling past losers and buying past winners) and exacerbate fluctuations in asset prices.

The existing empirical studies find rather mixed results for the trading patterns of

institutional investors in different markets. For institutional investors in U.S., Lakonishok et al. (1992) document a strong positive contemporaneous relation between institutional trading and stock returns, that is U.S. institutional investors follow momentum trading patterns, similarly, Grinblatt et al. (1995) find that mutual fund managers tend to pursue momentum investment strategies. Odean (1998) finds that the investors at a US brokerage house are reluctant to realize losses, and presents evidence that is consistent with contrarian investment strategies. Grinblatt and Keloharju (2000) is one of the few studies that address investment behaviour of many investor categories, including insurance companies and they conclude that foreign investors in Finland tend to be momentum investors, while domestic investors tend to be contrarians. Contrary to the momentum patterns of institutions in several countries, Karolyi (2002) and Kamesaka et al. (2003) find institutional investors in Japan follow contrarian trading.

Various papers have documented past-return based behaviour of investors for developed economy or large country and have got different results. Griffin et al. (2003) and Cai, and Zheng (2004) study trading behavior of institutions in U.S. and indicate a positive relationship between institutional trading and stock returns, while De Haan and Kakes (2011) indicate that three types of institutions, which are pension funds, life insurers, and non-life insurers in Netherlands and the results present that all three investor types tend to be contrarian trader.

2.3.3.3 Trading Pattern of Individual Investor

Other empirical studies, on the other hand, investigate the behavior of individual

investors and provide evidence that individual investment choices are also affected by past stock performance. In contrast, however, they show that individual investors exhibit mainly negative feedback trading or contrarian trading behavior.

Most empirical evidence shows that individual investors tend to follow contrarians such as Odean (1998, 1999, 2000), Grinblatt and Keloharju (2000), Ng Lilian and Wu Fei (2007), Kaniel, Saar, and Titman (2008), Aduda et al. (2012), and Birru (2015). Odean (1998, 1999) studies behavior of individual investors in the U.S. who trade using a large discount brokerage house. He finds that individual investors tend to hold on to their losers and sell their winners, which is consistent with individuals being contrarians and Barber and Odean (2000) find that on average individual investors are “antimomentum" investors: they tend to buy stocks that have recently underperformed the market and sell stocks that have performed well in recent weeks. Based on the executed buy and sell orders of individuals, Kaniel, Saar, and Titman (2008) find that individuals trade as if they are contrarians, at least in the short-run. Similarly, Grinblatt and Keloharju (2000) find contrarian tendencies of individual investors in Finland. In addition, Bae et al. (2002) report that trading of Japanese individual investors follow contrarian-trading patterns. Richards (2005) finds individual investors in six Asian emerging markets are contrarian investors.

Moreover, Ng and Wu (2007) report the trading behavior of individual investors in Mainland China and the results illustrate that individual investors with varying trade value engage in different trading strategies, however individuals at large are contrarian investors. Aduda et al. (2012) also present that some individual investors in Kenya exhibit rational behavior in making their investment decisions, while some

are irrational and always herding. Besides, Kaniel et al. (2012) indicate individual investors around earnings announcements using a data set of NYSE stocks. They present that individual investor buying (selling) predicts large positive (negative) abnormal returns on and after earnings announcement dates and also indicate that individuals trade in both return-contrarian and news-contrarian manners. Birru (2015) employ cross-sectional regression analysis during the sample period from 1967 to 2011 and find that individual investors in U.S. are momentum trader

2.3.3 Empirical Studies Investigating the Trading Performance of Different Types of Investors

Although a number of studies have explored the trading behavior of various investor types, not many studies have addressed their trading performances. The purpose of this review is twofold. The first is to identify the gap in the literature, which this study aspires to fill and the second is, by undertaking a critical review of the analytical techniques and research designs used, to establish the appropriate research methodology to be used in the present study.

This paper builds on three areas of investor behavior literature. The data allows for the study of foreign investors, institutional investors, and individual investors. The sections below briefly review the work in these three areas. Recent empirical studies have found that different types of investors have different sources of trading gains and losses.

Table 2-3: Empirical studies considering the trading performances of various investor types.

Author (s)	**Country**	**Investor type**	**Methods**	**Period**	**Results**
Brennan and Cao (1997)	U.S.	Foreign Investors	International Equity Portfolio Investment Flows Model	for the period of 1982 - 1994	Foreigners show Negative Trading Performance
Kang and Stulz (1997)	Japan	Foreign Investors	Value-Weighted Returns and Value-Weighted Market Returns	for the period of 1975 - 1991	Foreigners show Negative Trading Performance
Odean, 1998	U.S.	Individual Investors	Proportion of Realized Gains and Losses	January 1987 - December 1993	Individuals show Negative Trading Performance
Barber and Odean (2000)	U.S.	Individual Investors	Gross and Net Performance	for the period of 1991 - 1996	Negative Trading Performance

Grinblatt and Keloharju (2000)	Finland	Foreign and Domestic Investors	Proportion of Positive Buy Ratio Differences	December 1994 - December 1996	Foreigners show Positive Trading Performance, Domestic Investors show Negative Trading Performance
Hamao and Mei (2001)	Japan	Foreign Investors	Non-Parametric Test	July 1974 - June 1992	Foreigners show Negative Trading Performance
Karolyi (2002)	Japan	Foreign Investors	Cumulative Performance	January 1995 - March 2001	Foreigners show Positive Trading Performance
Kamesaka et al. (2003)	Japan	Foreign, Institution, and Individual	Net Investment Flow and Mean	January 1980 – October 1997	Foreigners and Institutions show

		Investors	Return		Positive Trading Performance, Individuals show Negative Trading Performance
Lin and Swanson (2003)	Taiwan	Foreign Investors	Net share (value) purchases of future winning stocks exceed net share (value) purchases of future losing stocks	December 1996 - June 2003	Foreign investors are Short-term Superior Performers but Long-term Inferior Performers.
Dahlquist and Robertsson (2004)	Sweden	Foreign Investors	Return of the Aggregate Portfolio and	for the period of 1993 - 1998	Foreigners show Positive Trading Performance,

			Regression of Excess Return		
Choe et al. (2005)	Korea	Foreign and Individual Investors	Cumulative Mean-Adjusted Returns	December 1996 – November 1998	Foreigners show Negative Trading Performance, Individual Investors show Positive Trading Performance
Dvořák, (2005)	Indonesia	Foreign and Domestic Investors	Cumulative Net Purchases	January 1998 - December 2001	Foreigners show Negative Trading Performance, Domestic Investors show Positive Trading Performance

Feng and Seasholes (2005)	China	Foreign and Domestic Investors	Proportion of Realized Gains and Losses	January 1999 - December 2000	Foreigners show Positive Trading Performance, Domestic Investors show Negative Trading Performance
Bae et al. (2006)	Japan	Foreign and Domestic investors	Net Cash Inflows	January 1991 - April 1999	Foreigners show Positive Trading Performance, Domestic investors show Negative Trading Performance
Froot and Ramadorai (2008)	International portfolio flows for	Foreign Investors	Closed-End Fund NAV Returns and	for the period of 1994 -	Foreigners show Positive

	various countries		Price Return	1998	Trading Performance
Barber et al. (2009)	Taiwan	Individual and Institutional Investors	Cumulative Abnormal Return	January 1995 - December 1999	Individuals show Negative Trading Performance, Institutions show Positive Trading Performance
Bae et al. (2011)	Korea	Foreign and Domestic investors	Portfolio Formation Returns	January 1996 - December 2002	Foreigners show Positive Trading Performance, Domestic investors show Negative Trading Performance
Kaniel et al. (2012)	U.S.	Individual Investors	Net Individual	January 2000 -	Positive Trading

			Trading and Abnormal Return	December 2003	Performance
Barber et al., (2014)	Taiwan	Individual Investors	Intraday Profits and Trade-Weighted Intraday Return	for the period of 1992 - 2006	Negative Trading Performance

Brennan and Cao (1997) investigated equity flows and found that the foreign investors achieve inferior performance because they are less informed than domestic investors. According to the model they used, it predicted that if foreign and domestic investors are differentially informed, then portfolio flows between two countries will be a linear function of the contemporaneous returns on all national market indices and if domestic investors have a cumulative information advantage over foreign investors about domestic securities, the coefficient of the host market return will be positive.

Kang and Stulz (1997) investigated the investment performance of foreign investors for 16 years. Out of these 16 years, foreign investors underperform the value-weighted PACAP (Pacific-Basin Capital Market Research Center) portfolio 9 times. Their average excess return relative to the value-weighted PACAP is negative over the whole sample period. The 1984 to 1985 year plays a crucial role in this

underperformance. For that year, foreign investors underperform the value- weighted PACAP portfolio by 1.28 percent. Without that year, though, there is no underperformance in average returns, but the median excess return is still negative and foreign investors still underperform 8 years out of 15. No case can be made that foreign investors choose a portfolio that has greater expected return than the market portfolio as one would expect if the explanation for the home bias is the existence of a proportional deadweight cost that applies to their investment in the foreign country.

Odean (1998) studied the behavior of individual investors and found that individual investors demonstrated a significant preference for selling winners and holding losers, except in December when tax-motivated selling prevails. This investor behavior does not appear to be motivated by a desire to rebalance portfolios or by a reluctance to incur the higher trading costs of low priced stocks. Nor is it justified by subsequent portfolio performance. It leads, in fact, to lower returns, particularly so for taxable accounts.

Barber and Odean (2000) analyzed the returns earned on common stock investments by 66,465 households at a large discount brokerage firm for six years. They documented that the gross returns before accounting for transaction costs earned by these households are quite ordinary, on average. Unfortunately, the net returns after accounting for the bid-ask spread and commissions paid by these investors earned by these households are poor. The average household underperforms a value-weighted market index by about 9 basis points per month or 1.1 percent annually. The poor performance of the average household can be traced to the costs associated with the high level of trading.

Grinblatt and Keloharju (2000) measured performance by examining whether the buy ratio of future winning stocks exceeds the buy ratio of future losing stocks during the sample period from 1994 to 1996. The results present that the performance differences between the sophisticated and unsophisticated investors should increase rather than decrease if taking into account transaction costs. This is because the most sophisticated investors, in this case are foreign investors and Finnish finance and insurance institutions, who generate the highest performance probably have relatively smaller transaction costs than the least sophisticated investors (households) who generate the worst performance.

Hamao and Mei (2001) developed a comprehensive framework for analyzing the impact of foreign investment on domestic financial markets. They used net purchases of securities as a proxy for investors' forecasts of future excess returns, and applied the market timing test of Henriksson and Merton (1981) to evaluate the market timing performance of various investment groups in the Japanese market and used the Campbell and Shiller (1988) approximate present value model. Their studied found that there is little evidence that trading by foreign investors tends to increase market volatility any more than trading of domestic groups, foreign investment improves liquidity in the Japanese market, also find no evidence of superior foreign investor market timing abilities.

Karolyi (2002) studied the performance of foreign investor in Japan by computing weekly average covariance measure and cumulate over different horizons of analysis, so that the cumulative performance is measured as the yen value of the investment. The results presented that foreigners had accumulated over 600 billion

yen by January 1997 and ended up with over 1200 billion yen by March 2001. Kamesaka et al. (2003) used weekly aggregate investment flow from Japan to study the investment performance of individual investors, foreign investors, and five types of institutional investors. The results presented that securities firms, banks, and foreign investors perform well over the sample period, while individual investors perform poorly, and foreign investor trading was associated with positive feedback market timing and that this trading earns high returns.

Lin and Swanson (2003) investigated investment performance of foreign investors in the sixty largest market capitalization firms in Taiwan's stock market from December 3, 1996 to June 11, 2003. Investment performance was measured using three measures of return (raw return, risk adjusted return, and momentum adjusted return) over five time horizons (daily, weekly, monthly, quarterly, annually). The findings show that foreign investors are short-term superior performers but long-term inferior performers. The short-term superior performance appears to be driven partially by price momentum of winners' portfolios rather than by risk taking. After controlling for firm size, share turnover, and industry, foreigners' short-term performance in large-size, high-turnover, and high-tech stocks is better than it is in small-size, low-turnover, and non-high-tech stocks.

Dahlquist and Robertsson (2004) analyzed the investment behavior of foreign investors in association with an equity market liberalization, and found a strong link between foreigners' trading and local market returns. In the period following the liberalization, net purchases by foreign investors induced a permanent increase in stock prices, suggesting that local firms reduced their cost of equity capital. The

results also showed a strong link between a firm's fraction of foreign ownership and the magnitude of the cost reduction. Foreign investors seem to prefer large and well-known firms, and these firms realize the largest reduction in capital cost. Furthermore, their analysis suggests that foreigners increase their net holding in firms that have recently performed well. Analyzing foreigners' performance, they found that foreigners got positive trading performance, suggesting that risk sharing is the most plausible explanation for the reduction of the cost of equity capital.

Choe et al. (2005) investigated whether domestic investors have an edge over foreign investors in trading domestic stocks. Using Korean data, they showed that foreign money managers pay more than domestic money managers when they buy and receive less when they sell for medium and large trades. The sample average daily trade-weighted disadvantage of foreign money managers is 21 basis points for purchases and 16 basis points for sales. There is also some evidence that domestic individual investors have an edge over foreign investors. The explanation for these results is that prices move more against foreign investors than against domestic investors before trades.

Dvořák, T. (2005) employed transaction data from Indonesia, this paper shows that domestic investors have higher profits than foreign investors. In addition, clients of global brokerages have higher long-term and smaller medium (intra-month) and short (intra-day) term profits than clients of local brokerages. This suggests that clients of local brokerages have a short-lived information advantage, but that clients of global brokerages are better at picking long-term winners. Finally, domestic clients of global brokerages have higher profits than foreign clients of global

brokerages, suggesting that the combination of local information and global expertise leads to higher profits.

Feng and Seasholes (2005) provided an in depth analysis of an investors' reluctance to realize losses and their propensity to realize gains in China during 1999 to 2000, a behavior known as the disposition effect. Together, sophistication and trading experience eliminate the reluctance to realize losses. The results presented that foreign investors tend to have positive trading performance, while domestic investors in China tend to have negative trading performance. However, an asymmetry exists as sophistication and trading experience reduce the propensity to realize gains by 37 percent. Their research design allows them to follow an individual's behavior from the start of his investing life/career. This ability makes it possible to track the evolution of the disposition effect as it is reduced and/or disappears.

Bae et al. (2006) examined the gains and losses from equity trades of individual investors, various institutional investors, and foreign investors in the Tokyo Stock Exchange. They employed the net cash flows and the trade-weighted performance measure and examine the impact of trading intervals, price spreads, and market timing on performance. The results presented that different investor types gain or lose from different sources, individual investors have poor market timing ability but potentially gain during short-run trading intervals as their average sell price is consistently higher than the average purchase price. In contrast, foreign investors consistently generate gains from trade due to good market timing, although their average sell price is lower than the average purchase price. Also, foreign investors

extract significant portion of their gains by trading against Japanese institutional investors when Japanese investors trade before their fiscal-year end.

Froot and Ramadorai (2008) used weekly data for 25 countries from 1994 to 1998. They found that in emerging markets, institutional flows forecast statistically indistinguishable movements in country closed-end fund NAV returns and price returns. In contrast, closed-end fund flows forecast price returns, but not NAV returns. Furthermore, institutional flows display trend-following (trend-reversing) behavior in response to symmetric (asymmetric) movements in NAV and price returns. The results suggested foreigners gained positive trading performance because foreign investors are more informed than domestic investors. Foreign investors perceive relevant fundamentals better than domestic investors. Thus, international portfolio flows predict returns.

Barber et al. (2009) investigated investors' gain and lose in Taiwan and found that individual investor trading results in systematic and economically large losses. Using a complete trading history of all investors in Taiwan, they documented that the aggregate portfolio of individuals suffers an annual performance penalty of 3.8 percentage points. Individual investor losses are equivalent to 2.2% of Taiwan's gross domestic product or 2.8% of the total personal income. Virtually all individual trading losses can be traced to their aggressive orders. In contrast, institutions enjoy an annual performance boost of 1.5 percentage points, and both the aggressive and passive trades of institutions are profitable.

Bae et al. (2011) investigated the trading behavior and performance of foreigners, local institutions, and individual investors in the Korean stock market. The results showed that the stocks foreigners buy significantly outperform the stocks they sell in terms of both stock returns and operating profitability, leading to the significant outperformance of foreigners' trading strategies over those of local investors. The results provided strong evidence that the superior performance of foreigners is attributed to their ability to discern between company stocks with good versus bad, at least short-term, prospects.

Kaniel et al. (2012) reported that net individual trading does have predictive power with respect to abnormal returns on and after dividend announcements, but the magnitude of the effect is smaller than that around earnings announcements. Stocks that individuals bought intensely in the two weeks before the announcements outperform those that they sold intensely, on average, by 3.80% in the three months following the event. In addition, the performance of this strategy during the event window is 0.29% compared with 1.47% for earnings announcements. Overall, they found that individual investor in U.S. gained from their trading.

Barber et al. (2014) defined day trading as the purchase and sale of the same stock by the same investor on the same day and analyzed the performance of day traders in two parts, which are the intraday returns earned on trades or the day trading return and the return on the open positions for the five days following a trade. Consistent with many prior works on the performance of individual investors, the vast majority of day traders lose money. In the average year during the sample period from 1992 to 2006, about 450,000 Taiwanese individuals engaged in day trading. Among

thousands of occasional day traders in the average year, 277,000 individuals engaged in day trades in excess of $NT 600,000 per year (about $US 20,000) and about 20% of these day traders earn positive abnormal returns net of fees (commissions and transaction taxes). Of course, some outperformance would be expected by sheer luck.

Furthermore, these literatures can be reviewed by classifying them into three main investors types as presented below:

2.3.3.1 Trading Performance of Foreign Investor

Some researchers have compared the performance of foreign investors with domestic investors, however these studies show mixed results. Several studies have illustrated that foreign investors do not necessarily have good trade performance, for instance Brennan and Cao (1997) examine equity flows between the U.S. and four developed countries and sixteen emerging markets and present the foreign investors achieve inferior performance because they are less informed than domestic investors. Besides, Kang and Stulz (1997) also report the investment performance of foreign investors for 16 years and find that out of these 16 years, foreign investors underperform the value-weighted PACAP (Pacific-Basin Capital Market Research Center) portfolio 9 times.

In contrast, Grinblatt and Keloharju (2000) document that foreign investors in the Finnish stock market, pursuing momentum strategies, generate superior investment performance, while individual investors do not pick future-winning stocks better than institutional investors and foreign investors. While, Hamao and Mei (2001) examine

the market timing performance of various investment groups in the Japanese market. The results show that there is little evidence that trading by foreign investors tends to increase market volatility any more than trading of domestic groups, foreign investment improves liquidity in the Japanese market, also find no evidence of superior foreign investor market timing abilities. Karolyi (2002) investigate foreign investor performance in Japan and present that foreigners had accumulated over 600 billion yen by January 1997 and ended up with over 1200 billion yen by March 2001.

Kamesaka et al. (2003) also show that foreign investors in the Japanese equity market have good market predicting ability of the market index, while Japanese individual investors have the clear poor market timing returns. Similarly, Lin and Swanson (2003) study investment performance of foreign investors in Taiwan's stock market and find that foreign investors are short-term superior performers, their short-term superior performance appears to be driven partially by price momentum of winners' portfolios rather than by risk taking. Dahlquist and Robertsson (2004) suggested foreign investors are not necessarily good at picking future winning stocks for the Swedish market. Foreign investors in the Swedish market seem to prefer large and well-known firms, and these firms realize the largest reduction in capital cost. Overall, foreigners seem to gain from their trading.

However, Choe et al. (2005) suggest that foreign investors do not have a private information advantage over Korean individual investors because foreign investors trade at worse prices than individual investors. Dvořák (2005) finds domestic investors in Indonesia have an information advantage over foreign investors on average, resulting in domestic investors have higher profits than foreign investors. In

addition, this paper exhibits that domestic clients of global brokerages have higher profits than foreign clients of global brokerages, suggesting that the combination of local information and global expertise leads to higher profits. The prior studies show that whether foreign investors perform better or worse than domestic investors is inconclusive.

Feng and Seasholes (2005) indicate that foreigners generally perform well compared with domestic investors in emerging markets. They find that foreign investors' trades predict future price movements and earn abnormal profits. Similarly, Bae et al. (2006) discover that foreign investors consistently generate gains from trade due to good market timing, although their average sell price is lower than the average purchase price. On the other hand, individual investors have poor market timing ability but potentially gain during short-run trading intervals, as their average sell price is consistently higher than the average purchase price. Bae et al. (2011) illustrate that the foreign investors purchase significantly outperform the stocks they sell in terms of both stock returns and operating profitability, which make them gain positive returns from their trade.

2.3.3.2 Trading Performance of Institutional Investor

In general, institutional investors have better resources and are better trained than individual investors. Institutional investors are subject to the same cognitive biases as individual investors, however better information and analysis skills may allow institutions to overcome these biases. Several researches have investigated on the behavior and performance of the institutional traders. The previous empirical results

have suggested that institutional traders are generally good performers of equity trading. Kamesaka et al. (2003) present that institutions are the clear market-timing winners of TSE. They study by using weekly aggregate investment flow and the results show that institutions, which are securities firms and banks perform well over the sample period from 1980 to 1997.

Correspondingly, Bae et al. (2006) study different sources of trading performances such as trading prices, and market timing of various investor types. They find that trading gains of proprietary traders tend to increase when domestic investors' trading gains decrease, which is indicated by large and negative correlations. The large and negative correlations of timing performance between domestic investors and foreign investors suggest that trading gains arising from market timing mostly shift between group of domestic investors and proprietary traders.

Dvořák, T. (2005) investigate domestic investors in Indonesia, the results show that domestic investors have higher profits than foreign investors. In contrast, Feng and Seasholes (2005) examine investor performance in China. The results present that during the sample period domestic investors in China tend to have negative trading performance. Barber et al. (2009) study the gain and loss of different type of investors and find that institutional investors in Taiwan enjoy an annual performance boost of 1.5 percentage points, and both the aggressive and passive trades of institutions are profitable. Bae et al. (2011) explore the performance of several investor types in Korea and find domestic investors underperform foreign investors during the sample period during 1996 to 2002.

2.3.3.3 Trading Performance of Individual Investor

The recent studies of individual investor behavior suggest that they frequently succumb to their cognitive biases. In letting behavioral problems such as disposition effect and overconfidence affect their investment decisions, U.S. individual investors are reluctant to realize losses (Odean, 1998) and tend to trade too much (Barber and Odean, 2000). Consequently, their investment performance is poor. Barber and Odean (2000) and Odean (1998) evaluate the timing of trades made by individual investors in the United States at a large discount brokerage firm. They use individual investors' portfolio returns and compared them against the various benchmarks, including the market portfolio and the multifactor benchmark. They find that individual investors get poor net returns after adjusting for trading costs by these investors. The average household underperforms market index by about 1.1% annually. After accounting for the fact that the average household tilts its common stock investments toward small value stocks with high market risk, the underperformance averages 3.7% annually. The average household turns over approximately 75% of its common stock portfolio annually; resulting in the poor performance of the average household can be traced to the costs associated with the high level of trading. The paper concludes that overconfidence can explain high trading levels and the resulting poor performance of individual investors.

Kamesaka et al. (2003) use weekly aggregate investment flow to study the investment performance of individual investors in Japan and find that individual investors perform poorly. Choe et al. (2005) investigate investors' trading performance in Korean and there is evidence that domestic individual investors have

an edge over foreign investors. Also, Dvořák, T. (2005) employ data from Indonesia and find that domestic investors have higher profits than foreign investors. While, Feng and Seasholes (2005) examine investors' performance in China during 1999 to 2000 and indicate that domestic investors tend to have negative trading performance. Bae et al. (2006) investigate the gains and losses from individual investors trading in the Tokyo Stock Exchange by employing the net cash flows and the trade-weighted performance measure and find that different investor types gain or lose from different sources such as individual investors have poor market timing ability but potentially gain during short-run trading intervals as their average sell price is consistently higher than the average purchase price.

Barber et al. (2009) also examine investors' gain and lose in Taiwan by employing a trading history of all types of investors in Taiwan, they find that individual investors loss from their trading, the aggregate portfolio of individuals suffers an annual performance penalty of around four percentage points. Kaniel et al. (2012) examine the net individual trading and find that the stocks that individuals purchased outperform those that they sold on average around 3.80 percent, therefore, individual investors in U.S. gain from their trading. While, Barber et al. (2014) investigate the performance of day traders and their results consistent with several previous works on the individual investors performance, the results show that the vast majority of day traders lose their money.

2.5 Summary and Conclusion

In this chapter provides an overview and discuss about main theories and models that related to the overall aim and objectives of this study. It has examined the underlying theoretical rationale of the lead-lag relationship, trading strategy and trading behavior in both spot and futures market. It has shown that in a perfectly functioning ideal world, every derivative price is determined simultaneously with its underlying asset price. Information flow in efficient market is assumed to be frictionless, in other words, neither derivative prices nor the underlying asset prices should lead the others.

However, many studies have found that this is not the case in the real world; there is a lead-lag relationship between spot and futures markets. The mixed empirical conclusions from the past studies arise from several reasons; take for example using different data frequency and different countries, some researchers such as Ghosh (1993), Shyy, Vijayraghavan and Quinn (1996), Kang et al. (2006), and Chen (2014) investigated lead lag relationship in developed countries and found that futures market leads spot market are according to the advantages provided by the futures market such as lower transaction costs, lower margins, higher liquidity, rapid execution, and greater flexibility for short positions. Whereas, several researchers such as Lucian (2008), Chen and Gau (2009), and Yang et al. (2012) studied the relationship between spot and futures market in emerging countries and found that spot leads futures market and the cash market dominates the futures market in price discovery. This is perhaps due to the fact that many domestic individual investors and foreign investors were practically prevented from trading in the futures markets

by the stringent regulations, and such high barriers to entry reduces the information content of the futures prices in the emerging futures market.

Besides, many literatures continue to debate whether the market is efficient, empirical evidence that appears to strongly contradict the random walk hypothesis has recently spurred the development of what has come to be known as behavioral finance. Many literatures indicate that investors may trade for a variety of reasons such as portfolio rebalancing, liquidity reasons, speculative reasons, and overconfidence. Trading may also be driven by changes in investor beliefs about the future stock prices along with the fundamental information about the firm, investors may look at price trends to formulate their trading decisions and they may follow trend-based heuristics such as momentum and contrarian strategies to decide when to buy and when to sell. That is why several studies have tried to examine the trading pattern and trading performance of different investor types such as foreign, institutional, and individual investors. For instance, Odean (1998) finds contrarian tendency of individual investors' behavior in the U.S. Nofsinger and Sias (1999) find the trading behavior of U.S. institutional investors follow momentum trading. Grinblatt and Keloharju (2000) examine investment strategies of different investor types in Finland and find individuals and institutions follow contrarian trading strategies while foreigners follow momentum investment strategies. Lin and Swanson (2003) find that foreign investors in Taiwan employ momentum trading strategies. Richards (2005) indicates that individual investors in Asian equity markets follow contrarian trading, Kaniel et al. (2012) illustrate that individual investor who trade in NYSE Stock are contrarian traders, Birru (2015) reports that individual investors are intermediate-horizon momentum traders, and Hu et al.

(2015) use the data from Taiwan stock by employing VAR model to measure feedback trading, they found the existence of positive-feedback trading in the Taiwan stock market, and investor sentiment plays a significant role in explaining positive-feedback trading strategies, particularly in periods of rising market sentiment.

Furthermore, academic researchers tend to view the foreign, institutional, and individual investors differently. Foreign and institutional investors are believed to be better informed, are financially sophisticated, and are much larger than individual investors. Individual investors, on the other hand, are considered to have psychological biases and may succumb to heuristic simplification in their decision-making. That is why several papers find evidence of foreign investors generate superior trade performance such as Grinblatt and Keloharju (2000) examine investors in Finland. Barber et al. (2009) find institutional investors gain positive excess returns whereas individual investors have poor market return the Taiwanese stock market.

The literature review presented here concentrates on the issues, which I will examine empirically. It reviewed the significant findings from earlier relevant research and identified the gap in the literature, which this study aspires to fill. Additionally, it examined the various methodologies employed by previous disclosure researchers. The literature review has also established the background for choosing the appropriate methodology to be used in the study. The background information provided in this chapter, together with the development of the theoretical framework and the review of the relevant literatures will be used to develop the research hypotheses in Chapter 4, Chapter 5, and Chapter 6. Additionally, the literatures

review presented in this chapter will be used in discussing the results of the statistical analyses in empirical result chapter.

Chapter 3. Data and Methodology

3.1 Introduction

This chapter outlines the data and research methodology to be used in the following empirical chapters. This chapter presents the important elements of the research design. It determines and clarifies the method and type of investigation carried out. This chapter discusses in depth the data and methodology to be employed in this research in order to test the research hypotheses developed in the previous chapter. In section 3.2 describes and sheds light on the data collection and data analysis. Thereafter, section 3.3 explains and justifies the methodological techniques and the empirical models to be used to test the research hypotheses. These empirical models were based on the theoretical models developed in the previous chapter. Section 3.4 concludes this chapter.

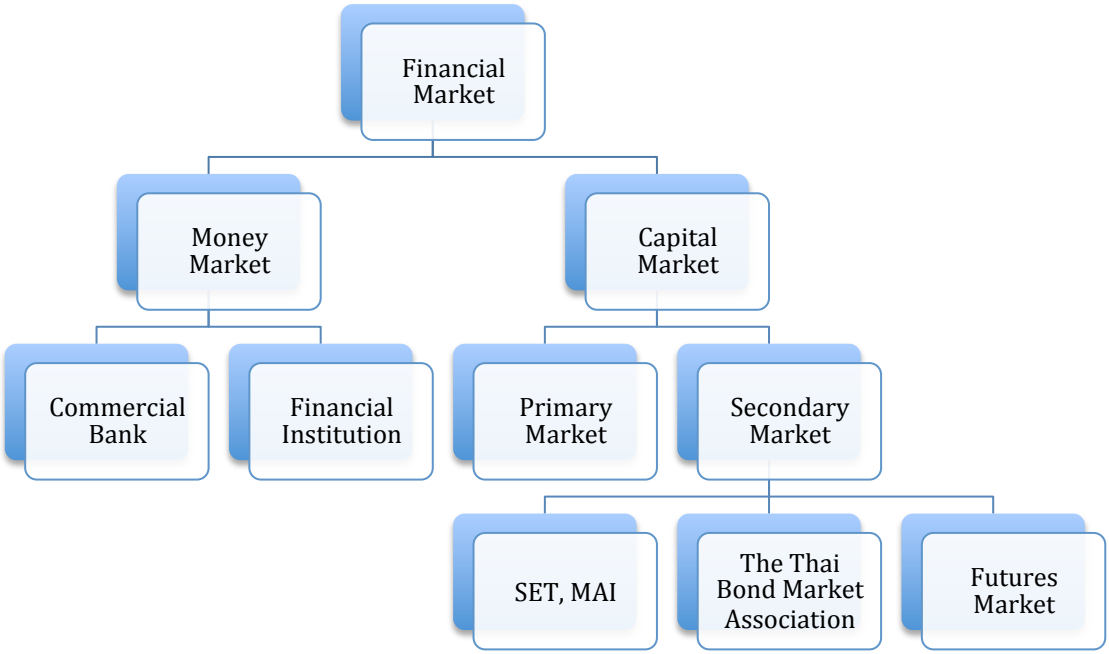
3.2 Data

3.2.1 Background on the Thailand Financial Markets

Financial market is a crucial component in the economic system. It is the engine that drives the economy, being a platform where surplus units meet deficit units and negotiate various kinds of financial agreement. The objective of financial market development is, therefore, to enhance the capability of the financial market to act efficiently as an intermediary. In Thailand, there are 4 main financial markets, which

are The Stock Exchange of Thailand (SET), The Market for Alternative Investment (MAI), The Bond Electronic Exchange (BEX), and The Thai Futures Exchange (TFEX).

Figure 3-1: The structure of financial market in Thailand.



3.2.2 Background on the Stock Exchange of Thailand and Thailand's Derivatives Market

The Thailand stock market officially started trading on 30 April 1975 and was named "The Securities Exchange of Thailand". On 1 January 1991, the exchange's name was formally changed to "The Stock Exchange of Thailand". Under the Securities and Exchange Act 1993, the Stock Exchange of Thailand is under supervision of the Security Exchange Commission (SEC). The trading on the Stock Exchange of Thailand is restricted to listed and authorized securities. The index of the Stock Exchange of Thailand is called the SET Index. The SET Index is a composite market

capitalization-weighted price index which compares the current market value (CMV) of all listed common stocks with its market value on the base date of April 30, 1975 (Base Market Value or BMV), which was when the stock market was officially started trading. The initial value of the SET index on the base date was set at 100 points.

Thailand's derivatives market has emerged since April 28, 2006. The first derivatives instrument trading at that time was the SET50 index futures which its underlying is the SET50 index. There are four contracts, which mature at the end of each quarter (March, June, September and December) trading in the market at the time. The multiplier for one index point is 1,000 baht and its minimum price fluctuation is 0.1 index points. The contracts are cash settled as opposed to the physical delivery of the underlying. All contracts are final settled at the business day immediately before the last business day of the contract month.

3.2.3 Data Collection Method

3.2.3.1 Data Collection Methods in Chapter 4

The data used in this research are time-series data (daily observations) from Stock Exchange of Thailand (SET) and Thailand's derivatives market. Trading in Thailand's derivatives market started on April 28th, 2006. The first derivative instrument trading at that time was the SET50 index futures which its underlying is SET50 index. There are 4 contracts that mature at the end of each quarter (March, June, September and December) trading in the market. The multiplier for one index

point is 1,000 baht and its minimum price fluctuation is 0.1 index points. The contracts are cash settled as opposed to the physical delivery of the underlying. All contracts are finally settled at the business day immediately before the last business day of the contract month.

SET50 index is the composite index using market capitalization weighting calculation, which includes top 50 stocks in terms of large market capitalization, high quality and compliance with the requirements regarding the distribution of shares to minor shareholders. The stocks in the index will be adjusted every six months. Its base date is on August 16th, 1995 at 1,000 points. SET50 index's closing price, it can be obtained from Reuters 3000 Xtra, which is a program that is typically used by professional traders and investment analysts in trading rooms. It provides real time streaming price on exchange traded stock, futures, bonds, and commodities.

SET50 index futures daily settlement prices can be found from SETSMART (SET Market Analysis and Reporting Tool), which is the web-based application from the Stock Exchange of Thailand, which can integrate comprehensive sources of Thai listed company data for example historical stock prices but the contract that will be used is only the nearest futures contract to maturity and is rolled over to the next contract on four days before last business trading day. The reason for switching contracts at this point is trading volume consideration, which point out the liquidity of the contract. The data set in this research are from secondary sources from the emerging country selected, Thailand, consists of 1,324 daily observations since April 28th, 2006 (which is the date that Thailand's Derivatives market has emerged) until September 30th, 2011.

3.2.3.2 Data Collection Methods in Chapter 5

In this research, I focus on the trading behavior in term of the trading patterns of various investor types in both spot and futures market by using the daily dataset from the Stock Exchange of Thailand (SET) and Thailand's futures market that separates investors into three types; foreign investors, institutional investors, and individual investors. First, SET index and its trading value can be obtained from Reuters 3000Xtra. Second, SET50 futures index and its trading volume can be found from SETSMART (SET Market Analysis and Reporting Tool) database but the contract that will be used is only the nearest futures contract to maturity and is rolled over to the next contract on four days before last business trading day. The reason for switching contracts at this point is trading volume consideration, which point out the liquidity of the contract. The transaction data provides information on each trade execution including trade execution time, amount of trade in baht, number of shares trade, and both buyer side and seller side information such as investor type.

I use individual account activity to classify investors according to their conditional pattern of share purchases and redemptions. The positive feedback traders (momentum investors) are reacting on a daily, as opposed to a weekly, monthly or annual basis by purchasing when the market rose and selling when the market fell in the previous trading session. The negative feedback traders (contrarian investors) are characterized in exactly opposite fashion. They buy after a drop in the market and sell after a rise. In this respect, they behave like "profit-takers" -- a term used frequently in the financial press to characterize investors who sell after a market rise. Of course it is possible to define positive and negative feedback trading over much

longer horizons. Indeed, in some cases for studies of momentum investing, for example, it would be useful to condition behavior on the market performance over previous weeks, months or years. However, in this case, definition of momentum investing is different from the way Grinblatt and Kellaharin (1998) apply the term in that profitable momentum strategies as documented empirically are cross-sectional and are based upon the past several months as opposed to days. In this paper, the choice of the daily horizon is based upon the analysis of aggregate trading flows in Goetzmann and Massa (1998), where found some evidence that, on average, investors reacted negatively to the previous day's market drop.

3.2.3.3 Data Collection Methods in Chapter 6

I use intraday transaction data compiled from the Stock Exchange of Thailand (SET) and the Thailand's Derivatives Market. The transaction data provides information on each trade execution including trade execution time; price; volume; and both buyer- and seller- side information. The data used in this paper identify trading volume (number of shares traded) and value (Thai Baht) for both purchases and sales over the June 2011–March 2014 period. The data are categorized according to different market participants. I group types of investors as follows foreign investors (denoted Foreigners in results throughout the rest of the paper for brevity), individual investors (Individuals), local institutional investors (Institutions). The overall sample consists of 684 daily observations.

The Stock Exchange of Thailand utilizes a fully computerized trading system where orders can either be automatically implemented by brokers or else brokers can

negotiate trades amongst themselves on behalf of clients. There has been a fixed commission rate of .25% of trade values, but market participants indicate that proprietary traders sometimes make trades on behalf of large retail clients to (surreptitiously) avoid the minimum fixed commission rate, thus benefiting clients and performing an additional proprietary trader role.

The Thailand's spot market and Thailand's futures market are a continuous auction limit order driven market and implements a multiple tick size regime that benefits small investors in particular, thus catering to the individual retail investors who dominate the market. These two markets have a morning and afternoon trading session with a lunch-time break, and the automated trading system continuously matches non-negotiated buy and sell orders according to price and then trade arrival timing priority.

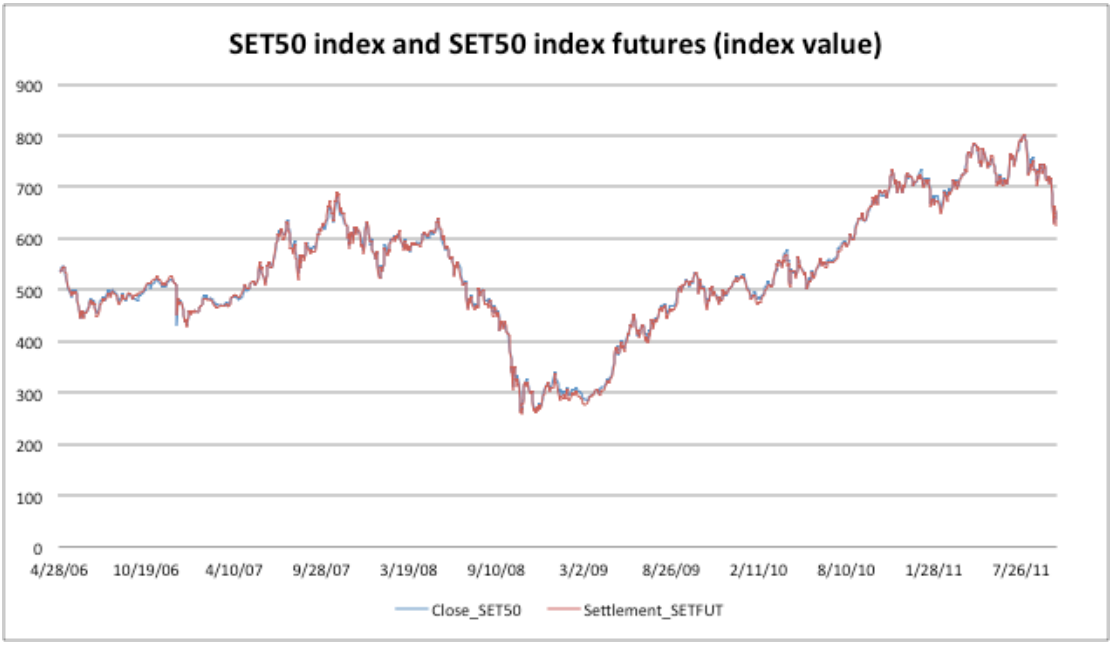
3.2.4 Data Analysis Method

3.2.4.1 Data Analysis Methods in Chapter 4

The data set in this paper is secondary data and consists of 1,324 daily observations. To analyze the data, I used Statistical Package for the Social Sciences (SPSS) and Econometric Views (Eviews) econometric program to plot graphs to see the trend and periodicity, to do descriptive statistics and to estimate the regression models. The daily index of settlement value of SET50 index and its associated SET50 index futures are plotted in Figure 3-2, these variables are said to be time series.

From the below graph, you can see the trend of both markets. The overall general tendency was quite fluctuated since the Thailand's derivatives market has emerged from April 2006 till September 2011. It is interesting that the pattern of both spot market and futures market are in the same way, which can imply that there are some relationships between these two markets. When one market goes up, another market goes up as well and vice versa.

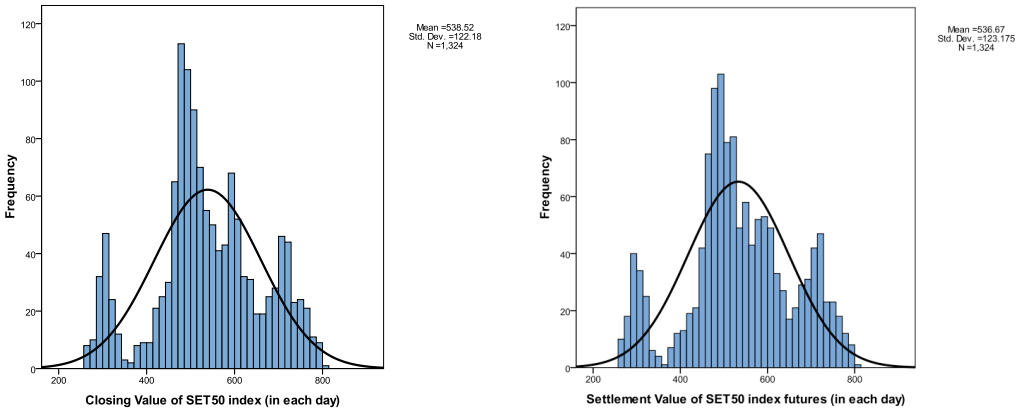
Figure 3-2: SET50 index and SET50 index futures.



The trend seemed to be upward during year 2006 to year 2007 due to the economic growth and then the trend dropped dramatically in the following year (year 2008) until it reached the lowest index point, which was about 260.00 points. According to the subprime crisis in the United State, which has the impact on the Thai economy, the spot stock market and derivative market were of course affected in line with other stock markets and derivative markets around the world. Fortunately, Thailand had sufficient foreign reserves to cover the capital outflow, and depreciation pressure on

the exchange rate could be managed fairly easily, it is shown in the chart that the stock index seemed to be recovered and then continuously increased from year 2009 to year 2011.

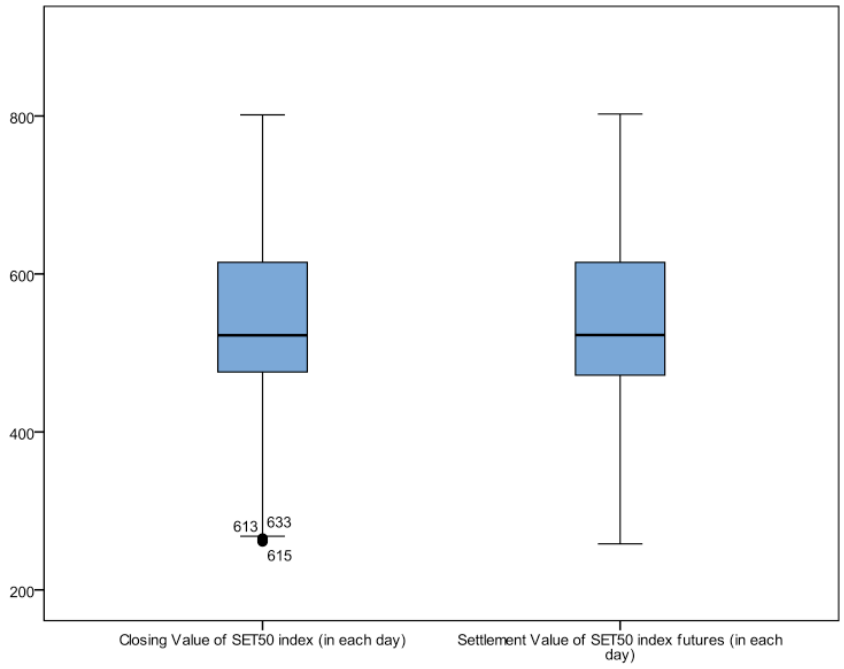
Figure 3-3: Frequency distribution**.**



From the charts above (Figure 3-3) provide a frequency distribution for SET50 index (spot index) and SET50 index futures, which are concerned with the stock market index during April 2006 to September 2011. The histograms show that the highest frequency of SET50 index futures and its underlying index are around 400 to 600 points and the standard deviation is approximately 120 points. The histograms of both spot and futures index are approximately symmetric and bell-shaped. The histograms and normal distribution lines in both markets are quite similar because there are some relationships between these two markets. When the new information comes, it has an effect to both of these two markets. The histogram shows that the index changes in the format up to one point and then down and so on. The loop index is likely to have the pattern of movement that may depend on the timing or the season.

To check central tendency (the median), dispersion (the range), and outlier are also shown in Figure 3-4, the boxplot for the index during year 2006 to year 2011 shows both mild and extreme outliers. Mild outliers and extreme outliers are any score more than 1.5 interquartile range (IQR) and 3 IQR respectively. Mild outliers are indicated by open dot whereas extreme outliers are indicates by stars. From the graphs, SET50 index and SET50 futures index, indicate that all series of SET50 index and SET50 futures index have very little mild outliers and have no extreme outliers thus I can conclude that overall, the outliers do not have any influence on the data.

Figure 3-4: Boxplots (SET50 index and SET50 index futures).

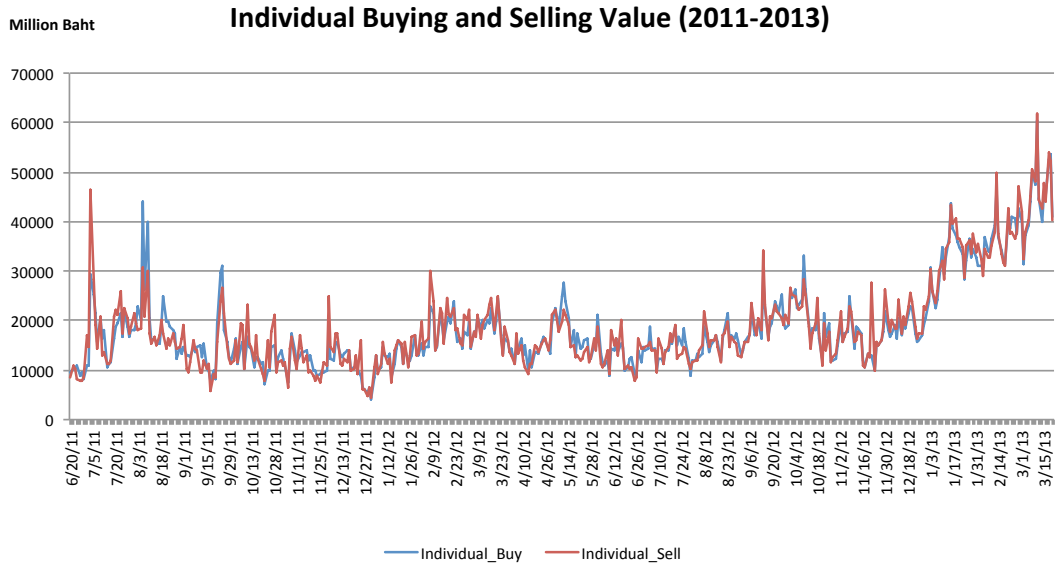


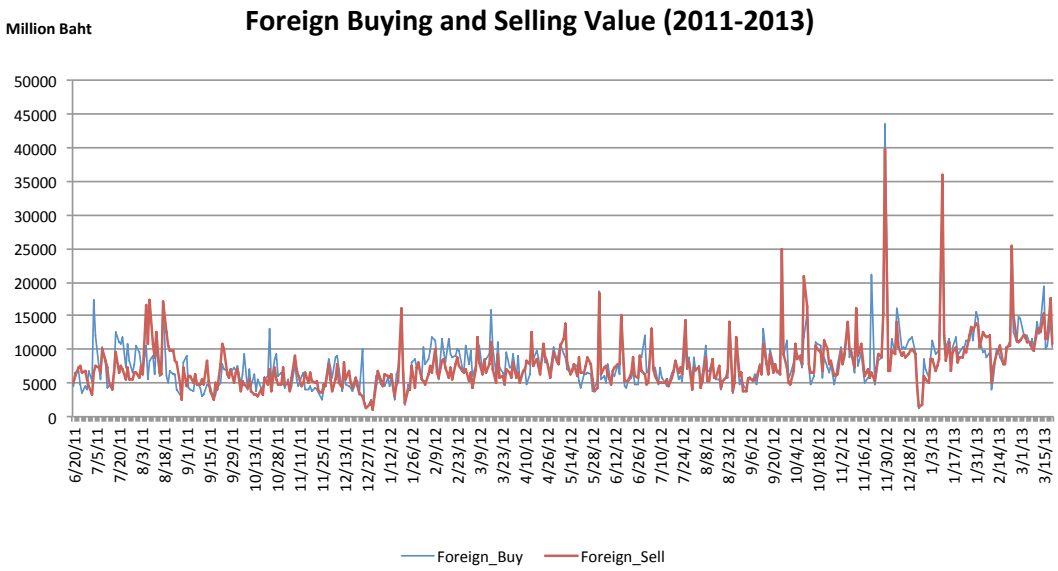
3.2.4.2 Data Analysis Methods in Chapter 5

The data set in this paper is secondary data, which consists of 435 daily observations. The daily trading of all types of investors are plotted in Figure 3-5 and 3-6, these

variables are said to be time series. Figure 3-5 and 3-6 present the daily trading value and daily trading volume respectively from June 2011 to March 2013. The figures below show the trend of both buying and selling of all investors who trade in Stock Exchange of Thailand and Thailand's Derivative Market. There is a high degree of fluctuation, however, it is interesting that the trading pattern of all investor types in both markets seem to be correlated, which can imply that there are some relationships among these groups of investors.

Figure 3-5: Trading value of both buying and selling side of all types of investors.




Million Baht
Foreign Buying and Selling Value (2011-2013)
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
6/20/11
7/5/11
7/20/11
8/3/11
8/18/11
9/1/11
9/15/11
9/29/11
10/13/11
10/28/11
11/11/11
11/25/11
12/13/11
12/27/11
1/12/12
1/26/12
2/9/12
2/23/12
3/9/12
3/23/12
4/10/12
4/26/12
5/14/12
5/28/12
6/12/12
6/26/12
7/10/12
7/24/12
8/8/12
8/23/12
9/6/12
9/20/12
10/4/12
10/18/12
11/2/12
11/16/12
11/30/12
12/18/12
1/3/13
1/17/13
1/31/13
2/14/13
3/1/13
3/15/13
Foreign_Buy
Foreign_Sell

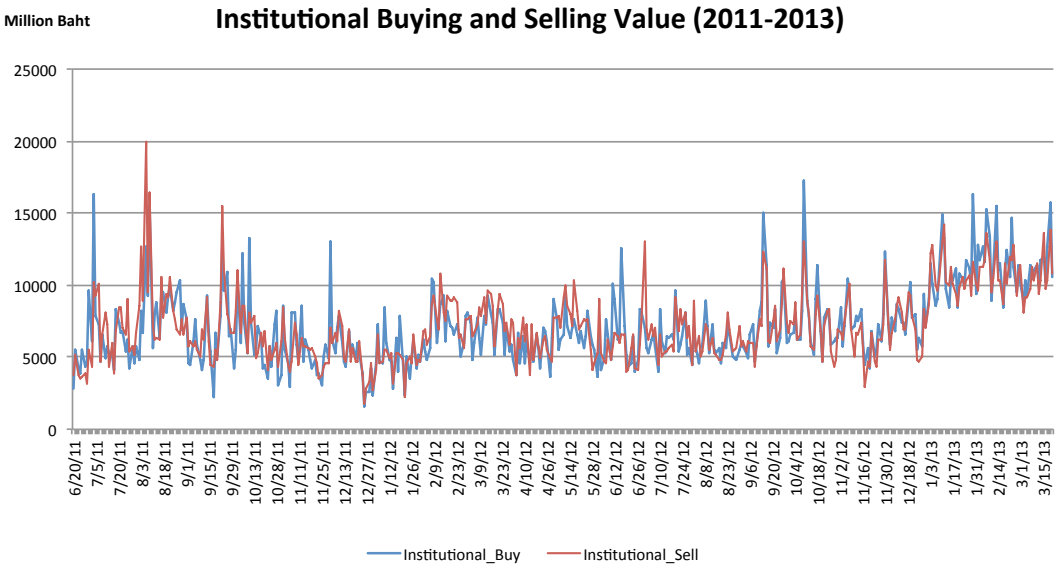
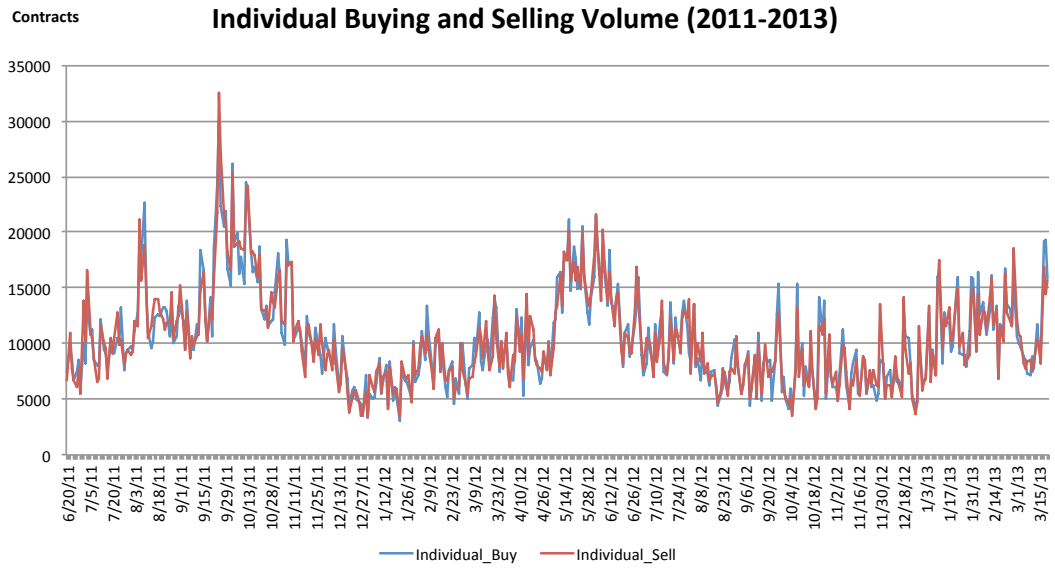
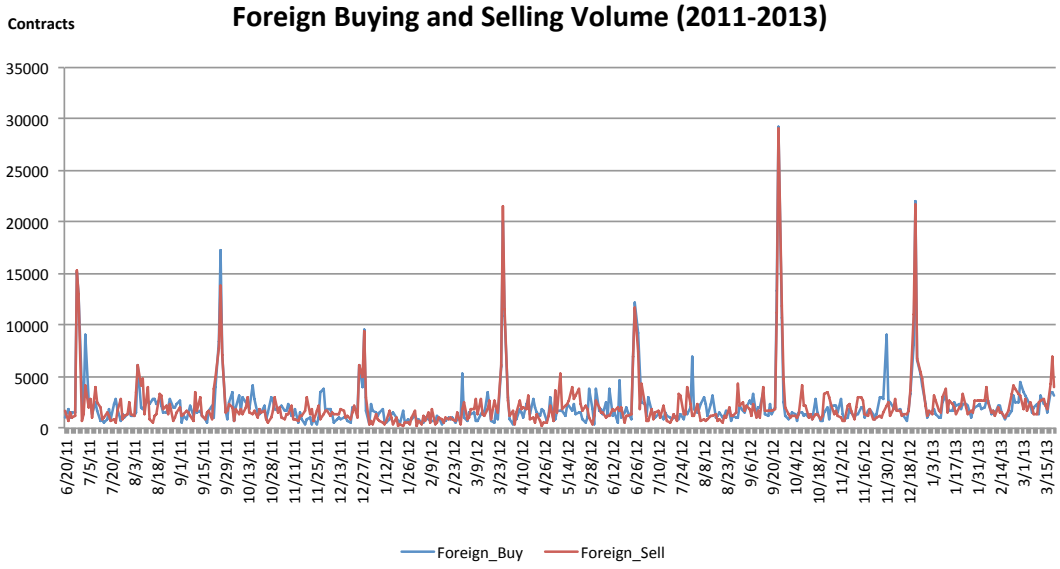
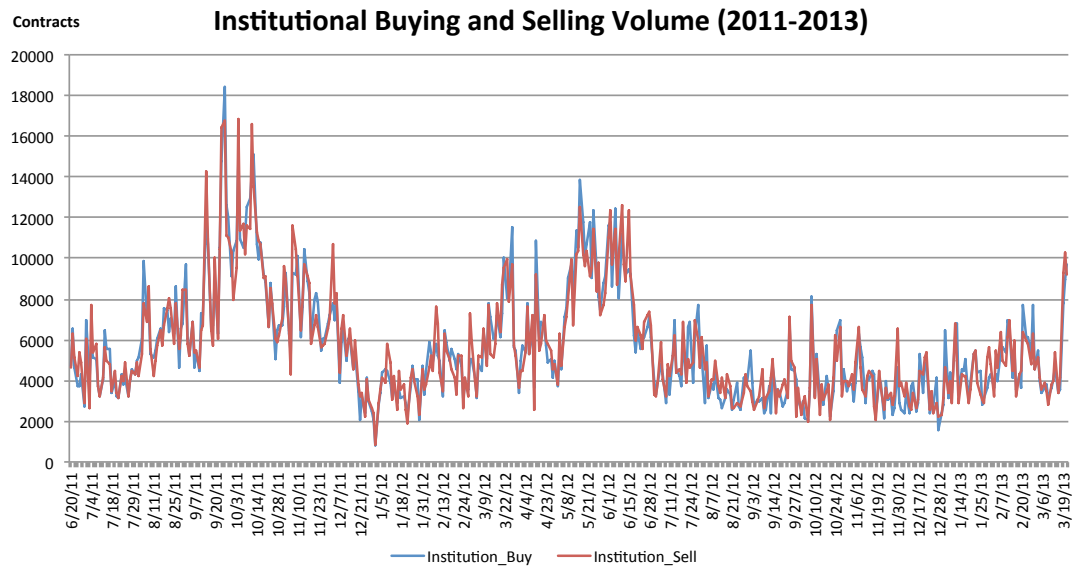

Million Baht
Institutional Buying and Selling Value (2011-2013)
25000
20000
15000
10000
5000
0
6/20/11
7/5/11
7/20/11
8/3/11
8/18/11
9/1/11
9/15/11
9/29/11
10/13/11
10/28/11
11/11/11
11/25/11
12/13/11
12/27/11
1/12/12
1/26/12
2/9/12
2/23/12
3/9/12
3/23/12
4/10/12
4/26/12
5/14/12
5/28/12
6/12/12
6/26/12
7/10/12
7/24/12
8/8/12
8/23/12
9/6/12
9/20/12
10/4/12
10/18/12
11/2/12
11/16/12
11/30/12
12/18/12
1/3/13
1/17/13
1/31/13
2/14/13
3/1/13
3/15/13
Institutional_Buy
Institutional_Sell

Figure 3-6: Trading volume of both buying and selling side of all types of investors.







The trend of trading value in Stock Exchange of Thailand seemed to be upward during mid year 2011 and then the trend slightly dropped according to the global economic conditions, political uncertainty, and devastating floods in Thailand. However, Thailand's economic activity and also investors' trading were gradually returning to normal during the last quarter in 2012, and continuously growing in 2013. While the trading volume of Thailand's Derivative Market seems to peak during the end of each quarter, which related to the maturity of the contracts that end in March, June, September, and December.

Table 3-1 and 3-2 summarize the trading value in baht and the trading volume in contracts by using daily aggregated buying and selling from the dataset. These buying and selling investment flows are classified to three investor groups, which are foreign investors, institutional investors, and individual investors. In the Stock Exchange of Thailand, foreign investors purchased stocks of 7,860 million baht per day on average for the SET index during the sample period. The minimum purchase amount was the last week in December 2012 with value of 1,253 million baht (on

December 25, 2012). The maximum purchase amount took place during the last week in November 2012 with value of 43,535 million baht (on November 30, 2012). For selling side, foreign investors sold stocks of 7,779 million baht a day on average. The minimum sales week, valued at 1,048 million baht, was during the last week in December 2011 (on December 30, 2011). The maximum sales week was valued at 39,683 million baht and was during the last week in November 2012 (on November 30, 2012). However, the data does not distinguish between foreign institutional and foreign individual investors.

For institutional investors, the averaged daily purchases and sales are 7,171 million baht and 7,188 million baht, respectively. When comparing with all investor types, individual investors were the largest trading groups on the SET index during the sample period. On average, they purchased stocks of 18,517 million baht per day and sold stocks of 18,691 million baht per day.

Table 3-1: Summary statistics of daily equity sales and purchases (unit: Million Baht).

	Foreign Investors		**Institutional Investors**		**Individual Investors**	
	Buying	Selling	Buying	Selling	Buying	Selling
Mean	7859.95	7668.88	7170.519	7187.526	18516.6	18690.67
Median	7222.22	6883.54	6571.54	6746.16	16053.44	16126.31
Maximum	43535.11	39683.36	17241.73	19916.9	60625.55	61857.25
Minimum	1253.24	1048.12	1588.67	1781.26	4061.16	4252.51
Std. Dev.	3774.066	3811.251	2627.259	2426.751	8908.122	9136.222
Skewness	2.979616	3.182745	1.030257	0.990233	1.696753	1.626508
Kurtosis	24.06485	22.34297	4.231868	4.863864	5.963613	5.884821

Jarque-Bera	8686.234	7515.891	104.4583	134.0567	367.9174	342.6405
Probability	0	0	0	0	0	0
Sum	3419078	3335963	3119176	3126574	8054723	8130441
Sum Sq. Dev.	6.18E+09	6.30E+09	3.00E+09	2.56E+09	3.44E+10	3.62E+10
Observations	435	435	435	435	435	435

Table 3-1 reports the descriptive statistics for the daily buying and selling of equities on the Stock Exchange of Thailand in million of baht. The trades are aggregated by investor type. The analysis uses the daily investment flow data during June 2011 to March 2013, which represents 435 days of trading.

Table 3-2: Summary statistics of daily equity sales and purchases (unit: contracts).

	Foreign Investors		**Institutional Investors**		**Individual Investors**	
	Buying	Selling	Buying	Selling	Buying	Selling
Mean	2235.191	2219.848	5606.692	5626.12	10381.97	10377.89
Median	1629	1575	4999	4938	9495	9624
Maximum	29216	29019	18429	16881	30146	32488
Minimum	342	170	798	853	3061	3426
Std. Dev.	2690.461	2656.703	2684.281	2663.478	4233.988	4214.266
Skewness	5.406886	5.436604	1.268596	1.331338	1.073125	1.150754
Kurtosis	40.92879	42.15324	4.778435	5.092934	4.4723	5.139732
Jarque-Bera	28193.99	29928.05	174.0032	207.8978	122.7797	178.9915
Probability	0	0	0	0	0	0
Sum	972308	965634	2438911	2447362	4516159	4514382

Sum Sq. Dev.	3.14E+09	3.06E+09	3.13E+09	3.08E+09	7.78E+09	7.71E+09
Observations	435	435	435	435	435	435

Table 3-2 reports the descriptive statistics for the daily buying and selling of equities on the Thailand's Derivative Market in contracts. The trades are aggregated by investor type. The analysis uses the daily investment flow data during June 2011 to March 2013, which represents 435 days of trading.

For Thailand's Derivative Markets, during the sample period, the averaged daily buying and selling volume of foreign investors are around 2,235 contracts and 2,220 contracts, respectively. Institutional investors bought about 5,607 contracts per day on average. The maximum buying amount was in the end of quarter 3 (on September 26, 2011) with volume of 18,429 contracts. For selling side, institutional investors sold around 5,626 contracts a day on average. The means of individual investor buying and selling are approximately 10,381 and 10,377 contracts, respectively.

Moreover, it is clear to see that the majority trader in the Stock Exchange of Thailand (SET) is the individual investor, followed by the foreign investor, and the last one is the institutional investor, whereas the major trader in Thailand's Derivative Market is the individual investor, then the institutional investor, and the foreign investor is the minority trader.

3.2.4.3 Data Analysis Methods in Chapter 6

Table 3-3 shows the descriptive statistics for the daily value and volume of the Stock Exchange of Thailand and the Thailand's Derivative Market by dividing investors into three groups, which are institutions, foreigners, and individuals. In the database, there are 684 observations.

Table 3-3: Summary statistics of daily equity sales and purchases in value and volume in the spot market.

Panel A: Summary statistics of daily equity sales and purchases value in the spot market (unit: million baht).

	Institutional Investors		**Foreign Investors**		**Individual Investors**	
	Buying	Selling	Buying	Selling	Buying	Selling
Mean	8.11E+03	7.98E+03	8.60E+03	8.81E+03	1.96E+04	1.95E+04
Median	7.40E+03	7.36E+03	8.07E+03	8.03E+03	1.70E+04	1.69E+04
Maximum	2.50E+04	2.51E+04	4.35E+04	3.97E+04	6.40E+04	6.28E+04
Minimum	1.59E+03	1.78E+03	1.25E+03	1.05E+03	4.06E+03	4.25E+03
Std. Dev.	3.37E+03	3.13E+03	3.77E+03	4.12E+03	8.91E+03	9.10E+03
Skewness	1.313841	1.201827	2.213715	2.234403	1.445234	1.420925
Kurtosis	5.437814	5.363183	16.39632	13.27739	5.334655	5.303289
Jarque-Bera	366.158	323.8224	5673.308	3579.454	393.4545	381.3656
Probability	0	0	0	0	0	0
Sum	5.55E+06	5.46E+06	5.88E+06	6.02E+06	1.34E+07	1.33E+07

Observations	684	684	684	684	684	684

Panel B: Summary statistics of daily equity sales and purchases volume in the spot market (unit: million shares).

	Institutional Investors		**Foreign Investors**		**Individual Investors**	
	Buying	Selling	Buying	Selling	Buying	Selling
Mean	6.87E+02	6.88E+02	4.48E+02	5.14E+02	6.07E+03	6.00E+03
Median	5.94E+02	5.52E+02	4.06E+02	4.52E+02	4.53E+03	4.51E+03
Maximum	2.38E+03	2.83E+03	1.79E+03	3.97E+03	4.45E+04	4.35E+04
Minimum	1.38E+02	1.35E+02	7.66E+01	4.67E+01	1.28E+03	1.32E+03
Std. Dev.	3.80E+02	3.84E+02	2.38E+02	3.32E+02	5.04E+03	5.01E+03
Skewness	1.007711	1.164846	1.336674	2.7155	3.629196	3.651567
Kurtosis	3.931701	4.616538	6.431403	21.50076	21.30022	21.35447
Jarque-Bera	140.5049	229.1589	539.2575	10595.55	11046.09	11121.33
Probability	0	0	0	0	0	0
Sum	4.70E+05	4.71E+05	3.06E+05	3.52E+05	4.15E+06	4.11E+06
Observations	684	684	684	684	684	684

Table 3-3 reports the descriptive statistics for the daily buying and selling of equities on the Stock Exchange of Thailand (SET). Panel A presents the summary statistic in million baht and Panel B presents the summary statistic in million shares respectively. The trades are aggregated by investor type.

During sample period, institutional investors, they averaged 8,117 million baht in daily purchases and 7,982 million baht in daily sales. The minimum and maximum buying day was in the last week of December 2011 with value of 1,589 million baht and in the third week of September 2013 with value of 24,971.72 million baht respectively.

Foreign investors purchased stocks of 8,605 million baht per day on average for the SET index during year 2011-2014. For, the minimum purchase day was 1,253.24 million baht in the last week of December 2012. The maximum purchase day was the last week in November 2012 with value of 43,535.11 million baht. For selling side, foreign investors sold stocks of 8,808 million baht a day on average. The minimum sales day, valued at 1,048 million baht, was during the fourth week in December 2011. The maximum sales day was valued at 39,683 million baht and was during the fourth week in November 2012. However, the data does not distinguish between foreign institutional and foreign individual investors.

Among all investor types, individual investors were the largest trading groups on the spot market during the sample period. On average, they purchased stocks of 19,567 million baht per day and sold stocks of 19,501 million baht a day. The individual investors had the highest trading day, purchasing 63,993 million baht and selling 62,791 million baht in March 2013.

Table 3-4: Summary statistics of daily sales and purchases in the futures market.

Panel A: Summary statistics of daily sales and purchases value in the futures market (unit: baht).

	Institutional Investors		**Foreign Investors**		**Individual Investors**	
	Buying	Selling	Buying	Selling	Buying	Selling
Mean	5409304	5405231	2700269	2692617	9290121	9303644
Median	4818055	4867861	1887513	1879555	8597981	8599497
Maximum	19939858	17624092	33028920	33049050	26840950	24179117
Minimum	569772	605032.9	232279.6	142953	2251366	2430062
Std. Dev.	2685469	2593326	3025956	3016513	3865093	3834947
Skewness	1.523132	1.417044	4.244987	4.265059	1.089997	1.060182
Kurtosis	6.456445	5.874431	29.30359	29.85404	4.55449	4.380081
Jarque-Bera	604.9619	464.3907	21772.81	22626.21	204.3111	182.4161
Probability	0	0	0	0	0	0
Sum	3.70E+09	3.70E+09	1.85E+09	1.84E+09	6.35E+09	6.36E+09
Observations	684	684	684	684	684	684

Panel B: Summary statistics of daily sales and purchases volume in the futures market (unit: contract).

	Institutional Investors		**Foreign Investors**		**Individual Investors**	
	Buying	Selling	Buying	Selling	Buying	Selling
Mean	6260.912	6257.215	3037.189	3016.924	10742.62	10766.58
Median	5617	5624.5	2176.5	2118.5	9919	9895.5

Maximum	19762	18779	35901	35392	30123	32465
Minimum	798	853	342	170	3061	3426
Std. Dev.	2979.728	2907.086	3313.025	3277.53	4276.727	4300.727
Skewness	1.28191	1.280331	4.30214	4.32177	1.038953	1.070335
Kurtosis	5.052507	5.061512	29.44963	29.9474	4.302618	4.5351
Jarque-Bera	307.3999	307.9943	22048.07	22824.89	171.4135	197.7615
Probability	0	0	0	0	0	0
Sum	4282464	4279935	2077437	2063576	7347949	7364338
Observations	684	684	684	684	684	684

Table 3-4 reports the descriptive statistics for the daily buying and selling of equities on the Thailand's Derivative Market in contracts in baht (Panel A) and contract (Panel B) respectively. The trades are aggregated by investor type.

In Table 3-4, Panel A shows the daily trading value of different investors types between June 2011–March 2014. Of all investor types, the major traders are the individuals, institutions, and foreigners. The averaged buying of individual investors account for 9.290 million baht. Other investor types, such as institutional and foreign investors account for 5.409 and 2.700 million baht for their averaged purchasing value, respectively. Panel B shows the average trading volume of different investor types in the Thailand's futures market. During the observation period, foreign investors and institutions were net buyers, and individual investors were net sellers on average.

3.3 Methodology

In relation to the objectives of this research as quantitative method, I will specifically investigate the lead-lag relationship of the spot index and the futures index of Thailand. The unit root test will be employed first to test for stationary of the data. Briefly explain this, this test is important because in the second step it is required that the time series would be cointegrated only if they are integrated of the same order. Next, the cointegration test will be utilized to observe a long-term equilibrium relationship between spot index and futures. If they are cointegrated, the error correction mechanism states that their short run dynamics will be corrected into the long-run equilibrium. At this step, the Error-Correction Model (ECM) will be constructed. In addition to assuming general linear relationship, this paper will determine the cost-of-carry model to be the long-run equilibrium equation. The ECM constructed from general linear relationship and cost-of-carry model will be used to test the lead-lag relationship. So, after extracting the lead-lag relationship between two time series, both models will be tested for the forecasting accuracy. The out-of-sample period will be set up in this case. The forecasting model will then be used in the trading strategy. Return of the strategy and the return of passive strategy (buy and hold) will be compared in the out-of-sample period. Next, the trading patterns will be examined by separating investors into three types, which are foreign investors, institutional investors, and individual investors. Finally, measuring trading performances of various investor types in both spot and futures markets by decomposing trading performance into two sources; trading price spreads, and market timing.

3.3.1 A Test of Stationarity and Why Test for Integration in the First Place?

Testing for the order of integration is standard in applied econometric work. The way a test is performed in applied work depends on the motive behind the test. We can find two motives behind unit root tests[12]. The first is knowing the order of integration is crucial for setting up an econometric model and do inference. The second motive is that economic theory suggests that certain variables should be integrated, a random walk or a martingale process. In this situation, it is motivated to perform very detailed tests, and take great care in finding exact critical values. The unit root test is motivated by theory, it will be one test in combination with other tests.

The most common motive is to investigate the properties of the prior to the construction of an econometric model. In this case, unit root tests are mainly a descriptive tool performed to classify series as stationary and non-stationary. Since integrated variables lead to non-standard distributions and perhaps spurious regression results, the recommendation is the following; If a data series appear to be non-stationary, assume as the maintained hypothesis, that it is non-stationary and integrated. Reject this hypothesis only, and only if, there is clear evidence for rejection.

[12] The unit root test is another type of statistical test favoured by researchers in the EMH literature. (See, for example, Dickey and Fuller (1981))

3.3.2 Cointegration Test

The notion of cointegration refers to the case where two or more variables move together over time and the difference between them is stable over time. Suppose that $y_t \sim I(d)$ and $x_t \sim I(d)$, then y_t and x_t are said to be cointegrated CI(d,b) if $(y_t - \beta x_t) \sim I(d-b)$ with $b>0$. If y_t and x_t are nonstationary, running regression between y_t and x_t could give us a spurious regression where there might be a high R^2 and significant t-statistic, but the results are without any economic meanings. Granger (1986) stated that the regression equation is necessarily meaningless if the residual series is nonstationary. If y_t and x_t are said to be cointegrated, this means that there is a long-run equilibrium relationship between y_t and x_t, the deviations from this relationship are the stationary deviations. The important note is that y_t and x_t must be integrated of the same order in order to be cointegrated.

Once variable have been classified as integrated of order I(0), I(1), I(2) etc. is possible to set up models that lead to stationary relations among the variables, and where standard inference is possible. The necessary criteria for stationarity among non-stationary variables is called cointegration. Testing for cointegration is necessary step to check if your modelling empirically meaningful relationships. If variables have different trends processes, they cannot stay in fixed long-run relation to each other, implying that you cannot model the long-run, and there is usually no valid base for inference based on standard distributions. If you do no not find cointegration it is necessary to continue to work with variables in differences instead.

After the previous section which employing the unit root test, I can identify the order of integration for SET50 index and SET50 index futures. If these two are integrated of different order, it is possible to conclude that they are not cointegrated. The next step before getting an idea about the lead-lag relationship is to find whether they are cointegrated if they are the same order of integration. This would imply to a long-run relationship between them.

3.3.2.1 Engle and Granger's Two-Step Procedure

There are several tests of cointegration. Engle and Granger (1987) formulated one of the first tests of cointegration (or common stochastic trends). This test has the advantage that it is intuitive, easy to perform and once you master it you will also realize it limitations and why there are other tests. In this paper, I utilized the Engle and Granger (1987) methodology to test the cointegration between SET50 index and SET50 index futures because the fact that there will be only two variables in the system, so I do not need to use the multivariate approach as suggested by Johansen (1988) suggested. The Engle and Granger method can be summarized into two steps. If I define F_t and S_t as the SET50 index futures and SET50 index prices, first running the following regression of F_t on S_t and get the residual. I will label the first approach that based on the Engle and Granger model as LR1 and the second approach that based on cost of carry model as LR2, which represent long-run equilibrium relationship between SET50 index futures and SET50 index by using Engle and Granger and cost of carry approach respectively.

Long-run equilibrium relationship between SET50 index futures and SET50 index by using Engle and Granger model or LR1:

$$\ln F_t = \theta_0 + \theta_1 \ln S_t + z_t \qquad (3.1)$$

$$\hat{z}_t = \ln F_t - \hat{\theta}_0 - \hat{\theta}_1 \ln S_t \qquad (3.2)$$

Where;

$\hat{z}_t$ = estimated residual of the long-run relationship

Second, the estimated residual from the first step will be tested for a stationary by using the ADF test. If the result shows that the residual is stationary, it means that SET50 index futures and SET50 index are cointegrated and its cointegration error will be $\hat{z}_t$. The unit root test process will be conducted similar to the unit root test as in the previous section suggested.

An alternative approach to the previous one, which assumes the linear relationship between futures and spot index is to assume explicitly an economic model of futures pricing. The cost-of-carry model will be used for this purpose. The futures price is determined by its underlying price, risk-free rate, dividend yield, and the time to maturity. In this case, the long-run equilibrium relationship is given by the following equation in section 3.3.2.2 cost of carry model.

3.3.2.2 Cost of Carry Model

According to the cost-of-carry valuation, the theoretical price at time t of an index futures contract that matures at time T equals the opportunity cost of keeping a basket replicating the spot index from t to T (Sarno & Valente, 2000), that is:

$$F_t = S_t e^{[(r-d)T]_t} \qquad (3.3)$$

Where;

F_t = futures price, S_t = spot index

r = (short-term) risk free rate

d = dividend yield

T = time to maturity

This model is expected to be superior to the equation from the previous approach because it takes an advantage of a theoretical equilibrium model, which maintains that the futures price is the spot index plus the cost of carry compounded continuously. Then, I can transform the above model by taking natural logarithm and obtain the result as below; the LR2 is the approach that based on cost of carry model.

Long-run equilibrium relationship between SET50 index futures and SET50 index by using Cost of Carry model or LR2:

$$\ln F_t = \ln S_t + [(r-d)T]_t \qquad (3.4)$$

Thus, its cointegration error will be defined as

$$\hat{\lambda}_t = \ln F_t - \ln S_t - [(r-d)T]_t \qquad (3.5)$$

This cointegration error obtained from the cost-of-carry model will be tested for the stationary property as in the previous approach. The stationarity of the cointegration error will imply that these two variables (futures and spot) are cointegrated applying the cost-of carry relationship (Racine & Ackert, 2000). For sake of comparison, I will label the first approach as LR1 and the second approach as LR2.

3.3.3 Error Correction Model

If two time series data are cointegrated, the Granger representation theorem states that the short-run dynamics of these two can be described by the Error-Correction Model (ECM). In the last section, I estimated the static or long-run equilibrium relationship between SET50 index futures and SET50 index by using LR1 and LR2 approach.

In this section, I will try to estimate the dynamic or short-run relationship, which has the disequilibrium terms from the above formula (LR1: Long-run equilibrium relationship between SET50 index futures and SET50 index based on Engle and Granger and LR2: Long-run equilibrium relationship between SET50 index futures and SET50 index based on Cost of Carry). I can use these terms to adjust the short-run behavior to its long-run value. The procedure of this adjustment is called the error correction mechanism.

This can be seen by the models below:

$$\Delta \ln S_t = \beta_1' + \beta_2' \hat{e}_{t-1} + \sum_{i=1}^{n} \psi_i' \Delta \ln S_{t-i} + \sum_{i=1}^{n} \varphi_i' \Delta \ln F_{t-i} + \upsilon_t' \qquad (3.6)$$

$$\Delta \ln F_t = \beta_1 + \beta_2 \hat{e}_{t-1} + \sum_{i=1}^{n} \psi_i \Delta \ln S_{t-i} + \sum_{i=1}^{n} \varphi_i \Delta \ln F_{t-i} + \upsilon_t \qquad (3.7)$$

Where;

$\hat{e}_{t-1}$ = cointegration error

υ_t and υ_t' = white noise disturbance terms

In this model, I can use standard OLS to estimate the parameters since each variable in (3.6) and (3.7) are now stationary if assuming that $\ln F_t$ and $\ln S_t$ are I(1) and they are cointegrated. The lagged terms of $\Delta \ln S_t$ and $\Delta \ln F_t$ will be included in each equation to yield the serially uncorrelated residuals. These lag lengths can be determined by AIC value as in the unit root test. The important of the parameter β'_2 and β_2 is that one or both of them should be significantly different from zero if the variables are cointegrated. The absolute values of these two indicate the speed of adjustment from deviation in short run to the long- run equilibrium relationship.

Now, I will construct two ECM based on different cointegration error obtained from LR1 and LR2 approaches. For the rest of this paper, the model that applies the cointegration error from LR1 will be called ECM1. On the other hand, the model which applies the cointegration error from LR2 will be called ECM2.

3.3.4 Lead-lag Relationship

Before I can move on to the trading strategy section, the important question is whether variables have lead-lag relationship or not. If I can find the relationship between two, perhaps I can exploit this link and find the strategy to take profit above the benchmark. I can utilize the ECM as I formed in the previous section to be the model in testing the lead-lag relationship. This model has an advantage of including both short-term dynamic and long-term equilibrium effect in the model; hence, the test is robust in term of durations. The Wald test will be employed as a measure of statistical inference to test this lead-lag relationship, as it is a well-known and simple method for a joint test. The model and its descriptions are summarized as follows.

Given that H(β) is an M ×1 vector linear function of β , the vector of parameters

So, H(β) = Rβ-r ; where R is an M ×K coefficient matrix

r is an M ×1 constant vector

Hypothesis

H_0: Rβ - r = 0 or Rβ = r

H_1: Rβ - r ≠0 or Rβ ≠r

$$\mathbf{W}_{cal} = \frac{[\mathbf{R}\hat{\boldsymbol{\beta}} - \mathbf{r}]^{\mathrm{T}} \left[\mathbf{R}[\mathbf{X}^{\mathrm{T}}\mathbf{X}]^{-1}\mathbf{R}^{\mathrm{T}} \right]^{-1} [\mathbf{R}\hat{\boldsymbol{\beta}} - \mathbf{r}]}{\hat{\sigma}^2 M} \sim F(M, n-K) \qquad (3.8)$$

The null hypothesis will be accepted only if $W_{cal} < F(M, n-K)$, otherwise reject H_0. The restriction for equation (3.6) is formed to test whether lagged future prices has a power affecting the current spot index. For equation (3.7), the restriction is also

formed to test in the other way (whether lagged spot index can affect to the current futures prices). The restriction will cover for both short-term effect and long-term effect represented by the coefficient of the other lagged variable in the equation and the coefficient of cointegration error. The results could be distinguished into four cases.

I. Unidirectional causality from futures to spot index if I can reject the null hypothesis in equation (3.6) and accept the null hypothesis in equation (3.7).
II. Unidirectional causality from spot index to futures if I cannot reject the null hypothesis in equation (3.6) but can reject the null hypothesis in equation (3.7).
III. Bilateral causality if null hypothesis of both equations are rejected.
IV. No causality if null hypothesis of both equations cannot be rejected.

3.3.5 Robustness Check

All the above processes exercise the SET50 index as an underlying to the SET50 index futures. However, as the robustness check, TDEX which is expected to be highly correlated with SET50 index could be used in this purpose. ThaiDex SET50 Exchange-Traded Fund (TDEX) is the first equity Exchange-Traded Fund in Thailand replicate the return of the SET50 index. The Exchange-Traded Fund is a security that tracks an index, a commodity or a basket of assets like an index fund but traded like a stock on an exchange. This type of securities has a major advantage of diversification and trading costs.

The advantages of TDEX can be summarized into three reasons. First, it has lower

commission fee than normal stocks. The commission of TDEX is set up at 0.1% but general stocks is set up at 0.25% or 0.15% if trade via the internet cash balance basis. Second, the minimum bid/ask spread (tick size) is very low at only 0.01 baht. Third, because TDEX can be short selling in the market, it can be viewed as the highly flexible instrument to trade the index both in bear and bull market.

The reason using TDEX as an alternative underlying is straightforward. TDEX is an ETF (Exchange-Traded Fund) which its investment mimic the return of SET50 index. Its price movement should highly correlated with the SET50 index and using it as the underlying cash asset for SET50 index futures maybe a very good proxy. With three advantages above and absolutely low transaction costs, it is meaningful to examine the lead-lag relationship between TDEX and SET50 index futures and compare the result when using SET50 index as in the preceding process. The consequence of this comparison can hint us regarding to the reason whether it exists a lead-lag relationship between spot and futures in Thai market.

3.3.6 Forecasting Accuracy

After constructing ECM1, ECM2 and reveal the lead-lag relationship between SET50 index futures and SET50 index, the performance of each model will be compared regarding to the forecasting accuracy in the out-of-sample period to determine which model would be used in a trading strategy. The sample size in this test will cover the period from October 1, 2011 to May 31, 2012 containing 162 observations. The Root Mean Squared Error (RMSE), Mean Absolute Error (MAE),

and the Mean Absolute Percentage Error (MAPE) will be used as criteria for evaluating a model's accuracy. These diagnostics are defined as follows:

$$RMSE = \sqrt{\frac{\sum_{i=1}^{n}(y_i - \hat{y}_i)^2}{n}} \quad (3.9)$$

$$MAE = \frac{1}{n}\sum_{i=1}^{n}|y_i - \hat{y}_i| \quad (3.10)$$

$$MAPE = \frac{1}{n}\sum_{i=1}^{n}\left|\frac{y_i - \hat{y}_i}{y_i}\right| \quad (3.11)$$

Where; y_i = actual value, and $\hat{y}_i$= forecasting value

On top of these three measures, I also calculate the percentage of cases where the forecasts predict the direction of the concerning series correctly. The model that yields the lowest RMSE, MAE, and MAPE and the highest correct predicted direction will be the best model and is chosen to be utilized in the trading strategy.

3.3.7 Trading Strategy

One of the main motivations of this research paper is to develop a trading strategy based on the ECM. Therefore, the first step is to find out the Error-Correction model, which has the most predictive ability. The trading period is the same as the forecasting period used, that is the most updated one-month period. This method won't be biased because its performance will be compared with the benchmark not itself. Assuming that futures lead spot, the benchmark (buy-and-hold strategy) return

will be computed using SET50 Total Return Index. I can link the ECM to the trading strategy by involving various methods. One of those is purchasing the underlying only if the predicted value from the model (at time t+1) is greater than the presented actual value (at time t). When the position is opened, it will be left until the predicted value is lower, then the position will be closed until the predicted value is greater than presented actual value again. When there is no position opened, the return will be computed using risk-free rate. The return from the strategy will be compared to the benchmark return described above.

3.3.8 Trading Patterns

In this section, I first attempt to identify the trading patterns of investor groups such as the positive (momentum) and negative (contrarian) feedback trading. I use trading value of investors who trade in spot market in order to eliminate high/low price effect of stock. That is, the investors can buy low (high) price stocks for large (small) amount of shares. To examine investor behavior, Kamesaka et al. (2003) employed the net investment flow (NIF). The net investment flow presents that whether investor type i is a net buyer or seller during day t. I calculate the following net investment flow (NIF) measure:

$$NIF_{it} = \frac{Buying_{it} - Selling_{it}}{Buying_{it} + Selling_{it}} \qquad (3.12)$$

From calculation above, net investment flow (NIF) can be interpreted as positive (negative) when the investor type buys more (less) equities than sells during the day, hence providing an indication of attempts to time the market should large net

investment flows be observed in either direction. Large net buying (selling) can therefore signal that the investor group thinks the market is undervalued (overvalued).

To investigate the feedback trading behavior; positive or negative feedback trading, it can be observed from the correlation coefficients on past market returns by the investor type. The feedback trading is also known as either "momentum trading pattern" when the net investment flow is positively correlated with past market return, or "contrarian trading pattern" when the correlation is negative with past market return. In addition, positive $NIF_{i,t}$ autocorrelation due to either large net buying or large net selling from week to week can help to indicate that an investor type is following a positive feedback, momentum style investment strategy, whereas negative feedback trading is present when an investor type trades against the prior market trading and direction. Correlations between current and lagged $NIF_{i,t}$ and lagged market returns can therefore provide an initial indication as to the presence of momentum or contrarian trading strategies by each investor type[13].

However, the NIF may be correlated with both past flow and past returns, multicollinearity may be cause for erroneous conclusions. Therefore, I need to be cautious in interpreting the correlation coefficients results. In order to factor in this problem, I investigate trading patterns by estimating the bivariate Vector Auto Regressive (VAR) model and take into account investment flow autocorrelation using the bivariate VAR (p) model.

[13] Univariate correlations do not control for other variables that can explain net investment flows whereas vector autoregressive analysis can potentially control for these additional explanatory variables. Correlations therefore provide an initial indication of the presence of momentum or contrarian strategies that can then be tested more formally using vector autoregressive analysis (see also the discussion in the results section).

I compute the VAR (p) test for the p lagged NIF coefficients and lagged SET return. To determine the number of lags for the model, the Akaike Information Criterion (AIC) is applied to suggest an appropriated number of lags p for this model. Let suppose, for example, that if the appropriated number is 3-period lags; p=3, it means that I observe the correlation between the trade flow and the period return of the SET index for the period of the investment flow (t=0) and during the previous 3 periods (t=-1, -2, -3). Then, employing VAR (p) to estimate the time-series behavior of net investment flows and returns on a daily basis and estimating the following equation with p lags (Goetzmann & Massa, 2002; Griffin et al., 2003; Kamesaka et al., 2003):

$$I_{i,t} = \alpha + \sum_{\tau=1}^{p} \beta_i R_{t-\tau} + \sum_{\tau=1}^{p} \lambda_i I_{i,t-\tau} + \sum_{\tau=1}^{p} \gamma_i I_{j,t-\tau} + \varepsilon_{i,t} \qquad (3.13)$$

where R_t is the SET index return for day t,

$I_{i,t}$ and $I_{j,t}$ are the vector of investor class flows (they are net investment flow (NIF) of investor type i for day t and NIF of another investor type j for day t, and $i \neq j$),

i and j represent type of investor; foreign, institutional, or individual investors.

The trading patterns (positive or negative feedback trading) can be observed by the correlation coefficients between net investment flow and past market returns (β_i) by the investor type.

If correlation coefficient (β_i) is significantly positive, it means the positive feedback trading pattern or momentum investing. That is, high (low) returns in one period will be associated with a high degree of investor buying (selling) in the next period.

If correlation coefficient (β_i) is significantly negative, it means the negative feedback trading pattern or contrarian investing. That is, high (low) returns in one period will be associated with a high degree of investor selling (buying) in the next period.

Moreover, this VAR(p) model also investigates herding behavior, herding is defined as a group of investors buying or selling at the same time interval (Nofsinger and Sias, 1999). The length of the time interval is an empirical issue and could be as short as 1 day or as long as 1 year. Theory suggests that investors could herd for rational reasons such as they are following the same information signals or investors could herd for irrational reasons like following fads (Kamesaka et al. 2003). The herding behavior can be observed from the correlation coefficients between current net investment flow and past net investment flow by the investor type as follows:

- correlation coefficients between current net investment flow of investor type i and past net investment flow of investor type i (λ_i)
- correlation coefficients between current net investment flow of investor type i and past net investment flow of another investor type j (γ_i)

If correlation coefficients (λ_i and γ_i) are significantly positive, it indicates the herding behavior. If correlation coefficients (λ_i and γ_i) are significantly negative, it doesn't imply the herding behavior.

3.3.9 Trading Performance

In this paper, I decompose trading performances of various investor types into two different sources, which are trading price spreads, and market timing. I employ the trade-weighted measure of trading performance using buy and sell volumes and values, which is developed by Bae et al. (2006). This measure provides more complete picture of the performance of different investor types in both Thailand's equity market and Thailand's derivatives market.

Following Bae et al. (2006), the measure decomposes net trading gains, *Π,* into two components; gains arising from price spreads and market timing.

$$\Pi_t = \pi_t^S + \pi_t^T \qquad (3.14)$$

π^S measures the excess gains that arises when investors trade portfolio of stocks that is different from the market portfolio. This gain is determined by the spread between trade-weighted buy and sell prices.

π^T measures timing ability in relation to the market index. This gain is determined by the allocation (or the market timing) of trades over the period. That means if the investors allocate their buy trades more than sell trades before increasing in market returns, they can get better market timing performance.

A. THE OVERALL NET TRADING GAINS, Π_t

The overall net trading gains, Π_t, can be defined as net cash inflows generated by trades over *h*-week trading interval from week *t*:

$$\Pi_t \equiv \left[Y_t^b \left(\frac{p_{t+h}^s}{p_t^b} \right)^{1/h} - Y_t^s \left(\frac{p_{t+h}^b}{p_t^s} \right)^{1/h} \right] \qquad (3.15)$$

This measure assumes that the investor buys v_t^b units (sell v_t^s units) at week *t* and sells (buys) the same volume or amount of units at week *t* + *h*, but allowing for different stock selections for each trade (Bae et al., 2006).

where $Y_t^b = v_t^b p_t^b$ is the baht amount of buy trades in week *t*

$Y_t^s = v_t^s p_t^s$ is the baht amount of sell trades in week *t*

p_t^b are trade-weighted buy prices;

where $p_t^b = \frac{\Sigma_{i=1}^n volume_i^b xprice_i^b}{\Sigma_{i=1}^n volume_i^b}$

p_t^s are trade-weighted sell prices;

where $p_t^s = \frac{\Sigma_{i=1}^n volume_i^s xprice_i^s}{\Sigma_{i=1}^n volume_i^s}$

v_t^b are buy volumes

v_t^s are sell volumes

Before calculating the overall net trading gains, Π_t, I adjust the baht amount of buy and sell trades to have the same median values (1,000 baht) for all types because the baht amount of trade are different.

$\frac{p^s_{t+h}}{p^b_t}$ and $\frac{p^b_{t+h}}{p^s_t}$ is the intertemporal spreads of trade-weighted average prices, which reflect the stock selection as well as the trade weights of shares each investor type chooses to trade. The stock selection refers to the choice of stocks that investors choose to buy and sell at the beginning of the holding period.

The implication of performance measure, that is, if overall net trading gain is positive (negative), $\Pi_t > 0$ (< 0), it implies that the net cash flow from trade at time t and $t + h$ increases (decreases) the level of the underlying portfolio under the assumption that the same number of shares are traded at time t and $t + h$.

B. THE PRICE SPREADS, π^S

The net trading gains that arise due to intertemporal price spread between sell and buy prices in excess of the market benchmark, π^S can be defined as follows (Bae et al., 2006):

$$\pi^S_t \equiv \left[Y^b_t \left(\frac{p^s_{t+h}}{p^b_t} \right)^{1/h} - Y^s_t \left(\frac{p^b_{t+h}}{p^s_t} \right)^{1/h} \right] - \left[\left(Y^b_t - Y^s_t \right) \left(R^M_{t+h} \right)^{1/h} \right] \qquad (3.16)$$

where R^M_{t+h} is the h-week holding period return of the market index

$\left(Y_t^b - Y_t^s\right)\left(R_{t+h}^M\right)^{1/h}$ is the net trading gains when investors trade the market index

The implication of performance measure that is if net gains arising from price spreads is positive (negative), $\pi^S > 0$ (< 0), it implies net trading gains (losses) that arise due to price spread between sell and buy prices in excess of the market benchmark.

C. THE MARKET TIMING, π^T

This point, this paper focused on the security selection ability of each investor group. By calculating trading gains net of any market return and estimating market timing gains and losses as follows (Barber et al., 2009). On each day, I sum the total value of stock purchases and the total value of stock sales for each investor group. π^T is the measure of timing ability in relation to the market index. Since I standardize the baht amount of buy and sell trades to have the equal median values ($\bar{Y}_t^b = \bar{Y}_t^s$=1,000 baht), the net buy trade (buy minus sell trade) for the observation period is zero.

π^T can be defined as follows:

$$\pi_t^T \equiv \left(Y_t^b - Y_t^s\right)\left(R_{t+h}^M\right)^{1/h} - \left(\bar{Y}_t^b - \bar{Y}_t^s\right)\left(R_{t+h}^M\right)^{1/h} = \left(Y_t^b - Y_t^s\right)\left(R_{t+h}^M\right)^{1/h} \quad (3.17)$$

The interpretation of the net trading gains from actual trades in excess of the net gains from a passive benchmark strategy that trades a constant amount, $\bar{Y}_t^b$ and $\bar{Y}_t^s$,

each week. A greater π^T presents the better timing performance since the investor buys (sells) before the increasing (decreasing) in market return.

According to the trade performance measure above, I next conduct a test against the null hypothesis of zero median using the non parametric signed-rank test. Note that sum of the net gains do not equal overall gains because each component represents the median for sample.

For the overall net trading gains, the null hypothesis is $H_0 : \Pi_t = 0$.

The implication of performance measure, that is, if overall net trading gain is positive (negative), $\Pi_t > 0$ (< 0), it implies that the net cash flow from trade at time *t* and *t* + *h* increases (decreases) the level of the underlying portfolio under the assumption that the same number of shares are traded at time *t* and *t* + *h*.

For the net gains arising from price spreads, the null hypothesis is $H_0 : \pi_t^S = 0$

The implication of performance measure, that is, if net gain arising from price spreads is positive (negative), $\pi^S > 0$ (< 0), it implies net trading gains (losses) that arise due to intertemporal price spread between sell and buy prices in excess of the market benchmark.

For the net gains arising from market timing, the null hypothesis is $H_0 : \pi_t^T = 0$

The implication of performance measure can be interpreted as follows:

If net gains arising from market timing ability are positive, $\pi^T > 0$, it implies the better timing performance since the investor buys (sells) before the increasing (decreasing) in market return. If net gains arising from market timing ability are negative, $\pi^T < 0$, it implies the worse timing performance since the investor buys (sells) before the decreasing (increasing) in market return.

Instead of examining the heavy buying and selling days, this paper evaluates the ability of the investor groups over the entire period as indicated in Kamesaka et al., (2003). The following empirical specification estimates the cumulative return due to the daily changes in investment flow and the following market return (Kamesaka et al, 2003; Barber et al., 2009; Bae et al, 2011):

$$\text{Aggregate Following One Day Return}_{it} = \sum^{s=t} (\text{Buying}_{is} - \text{Selling}_{is})\, R_{s+1} \qquad (3.18)$$

This equation is estimated for each investor group. The cumulative return results will present by using graphs. The numbers on the horizontal axis of the figure represent time. The y-axis shows the cumulate return in million baht.

Lastly, I also investigate the correlations of overall trade performance (Π), price spread performance (π^s), and timing performance (π^t) between various investor types estimated for the best trading interval. The p-values then are observed by the Wilcoxon signed-rank test for three gains. Referring to Wilcoxon (1945), the

Wilcoxon signed-ranks test is a non-parametric alternative to the paired t-test, which ranks the differences in performances of classifiers for each data set, ignoring the signs, and compares the ranks for the positive and the negative differences. Let d_i again be the difference between the performance scores of the two classifiers out of N data sets. The differences are ranked according to their absolute values; average ranks are assigned in case of ties. Let R+ be the sum of ranks for the data sets on which the second algorithm outperformed the first, and R− the sum of ranks for the opposite. Ranks of $d_i = 0$ are split evenly among the sums; if there is an odd number of them, one is ignored:

$$R^+ = \sum_{d_i>0} \text{rank}(d_i) + \frac{1}{2}\sum_{d_i=0} \text{rank}(d_i) \qquad R^- = \sum_{d_i<0} \text{rank}(d_i) + \frac{1}{2}\sum_{d_i=0} \text{rank}(d_i).$$

Let T be the smaller of the sums, T = min(R+, R−). Most books on general statistics include a table of exact critical values for T for N up to 25 or more. For a larger number of data sets, the statistics is distributed approximately normally. With $\alpha = 0.05$, the null-hypothesis can be rejected if z is smaller than −1.96.

$$z = \frac{T - \frac{1}{4}N(N+1)}{\sqrt{\frac{1}{24}N(N+1)(2N+1)}} \qquad (3.19)$$

The Wilcoxon signed ranks test is more sensible than the t-test. It assumes commensurability of differences, but only qualitatively: greater differences still count more, which is probably desired, but the absolute magnitudes are ignored. From the statistical point of view, the test is safer since it does not assume normal

distributions. Also, the outliers (exceptionally good/bad performances on a few data sets) have less effect on the Wilcoxon than on the t-test. Referring to Bae et al. (2006), they find the results for different trading intervals (h) are qualitatively similar. The large and negative correlations imply that net trading gains shift between one investor type and another type.

3.4 Summary and Conclusion

This chapter has presented the data and methodologies, which are undertaken in the next chapter. The data in this research was collected from the Stock Exchange of Thailand and Thailand's derivative market that has high quality and reliability. This chapter presented and tried to justify the methodologies I follow to examine the research questions.

More specifically, in order to examine the research questions of this research, I follow a time series analysis. The chosen methodology that will be employed first is the unit root test to test for stationary of the data. Then, the cointegration test will be utilized to observe a long-term equilibrium relationship between spot index and futures. If they are cointegrated, the error correction mechanism states that their short run dynamics will be corrected into the long-run equilibrium. Next, the error-correction model (ECM) and the cost of carry model will be constructed. These two models are created in order to see which one has better forecasting power. As an alternative and the robustness check, this research also investigates the lead-lag relationship of SET50 index futures and TDEX.

After extracting the lead-lag relationship between two time series, both models will be tested for the forecasting accuracy. The out-of-sample period will be set up in this case. The best forecasting model will then be used in the trading strategy. Return of the strategy and return of the passive (buy and hold) strategy will be compared in the trading period. Then, the trading behavior will be tested to identify the trading patterns of various investor types (foreign, institutional, and individual investors) such as the positive (momentum) and negative (contrarian) feedback trading.

To examine the trading patterns, I use daily aggregated buying and selling flows to calculate the net investment flow (NIF) using an intraday dataset of the Stock Exchange of Thailand (SET) and Thailand's Derivative Market. The intraday data contains all orders (volume and amount of trade). After that, trading performance will be tested by using more powerful performance measurement, which is not only compares the trading performance of all investor types across the entire equity market, but also measures trading gains and losses from different sources. This measure decomposes trading performances into two sources; trading price spreads, and market timing presented more complete picture of the performance of various investor types.

Chapter 4. Empirical Analysis and Results

"An empirical examination of the lead-lag relationship between spot and futures market: evidence from Thailand"

4.1 Introduction

In a perfectly functioning ideal world, every derivative price is determined simultaneously with its underlying asset price. In other words, neither derivative prices nor the underlying asset prices should lead the others. New information disseminated in the market should be reflected immediately and simultaneously in the prices of derivatives as well as in the prices of their underlying assets. However, in reality, these simultaneous price movements among the financial markets may not be observed due to several factors such as the differences in transaction costs and institutional settings of the financial markets.

This chapter empirically investigates the lead lag relationship in the spot stock market and the futures market in Thailand and presents the results from the empirical analysis on the relationship between spot and futures market also the profitable trading strategy. Additionally, it presents an in-depth look at the findings of the research and links the results of this study to the previous empirical literatures.

4.2 Background

In rational efficient market returns on derivative and underlying securities should be perfectly contemporaneously correlated, every piece of information should be reflected simultaneously in the underlying spot market and its derivatives markets, thus there should be no lead–lag relationship between one market and the other. However, many empirical studies have found that this is not the case in the real world. Several papers discovered that the futures price leads its underlying index such as Ghosh (1993), Tse (1995), Shyy, Vijayraghavan and Quinn (1996), So and Tse (2004), and Kang et al. (2006). While some researchers found the bi- directional relationship such as in Pizzi et al. (1998), Gee and Karim (2005), and Jackline and Deo (2011). Some argued that the spot index leads its associated futures index such as Lucian (2008), Bohl, Salm and Wilfling (2009), Cabrera, Wang and Yang (2009), Chen and Gau (2009), and Yang, Yang and Zhou (2012).

Given the mixed empirical findings and the limited research on this issue in emerging markets an interesting and relevant area of study would be a setting with a nascent futures market to examine whether a lead-lag relationship holds and if so in which direction. Therefore, in this study I investigate this issue using data from Thailand's stock and futures markets. Thailand's stock market is small by international standards and its derivatives market is relatively young therefore the question of whether the markets are efficient is important for both participants and regulators of these markets. For investors the finding of a lead-lag relationship may present opportunities for higher returns on their trading strategies. On the other hand, regulators would be interested to know how quickly one market reacts to new

information and to what degree the two markets are linked. Due to market imperfections, one of these two markets may reflect information faster. More specifically, the lead-lag relationship between price movements of stock index futures returns and underlying cash market returns illustrates how fast one market reflects new information relative to the other, and how well the two markets are linked together.

High volatility and associated market risk have increased the demand for hedging instruments, designed to protect value by transferring risks from one party to another. One of the most important hedging instruments is a futures contract. A futures contract is a legally binding agreement to buy or sell a specific quantity of the underlying asset at a predetermined date in the future at a price agreed on today. To facilitate trading and clearing, futures contracts are standardized in all aspects apart from price. Stock index futures have a variety of attractive features for a trader who wishes to trade the share portfolio corresponding to the index. Traders frequently take coincident positions in both the cash and futures markets, which motivate the body of research investigating the relationship between the two price series.

Stock market prices have been analyzed over many decades in many ways to determine whether price changes are forecastable or not. One technique, called cointegration, has been developed; Granger (1981) introduced the concept of cointegration where two variables may move together although they are nonstationary. The rationale behind the concept of cointegration is that there exists a long-run equilibrium relationship between the two variables. In the short-run they may deviate from each other but market forces, government intervention, etc. will

bring them back together. Engle and Granger (1987) extended this concept and showed that cointegrated series have an error correction representation and conversely. With the error correction representation, a proportion of the disequilibrium in one period is expected to be corrected in the next period.

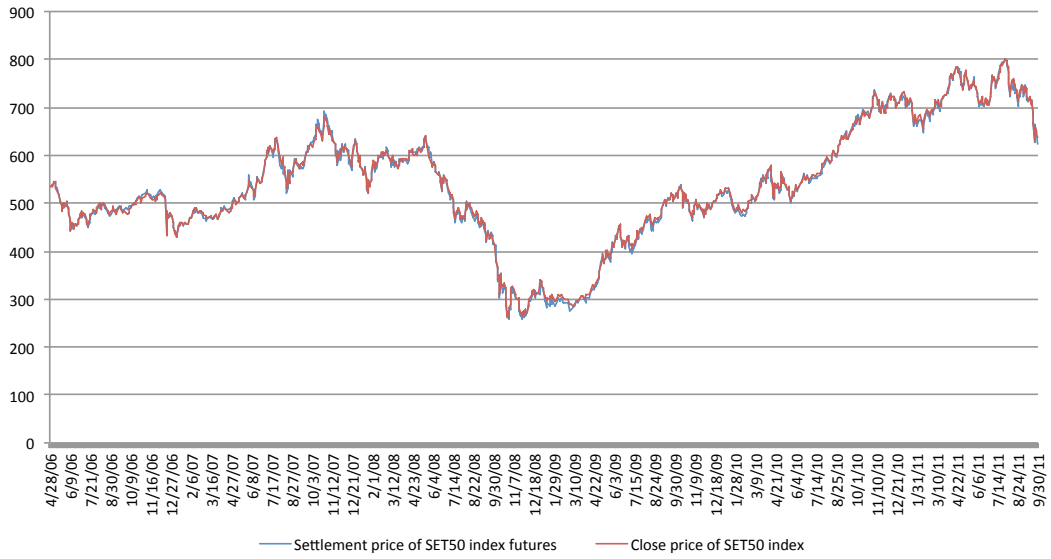
Following previous literatures that investigate the relationship of stock index and associated index futures series, this paper models empirically the temporal relationship between the price movements of the SET futures contract and its underlying asset, the SET index. By employing a number of techniques drawn from time series econometrics, I attempt to establish the model with the best forecasting ability. The issue under consideration is whether the index fully reflects all available information or, conversely, whether there are systematic profitable opportunities, which could be exploited using a trading strategy.

The purpose of this research is to investigate whether the index spot and futures price changes are predictable or not with econometric methodology that marries the short-run dynamic adjustment and long-run relationships between economic variables and to attempt to identify profitable trading strategies. Is there any causal relationship between spot and futures price changes? What is the direction of causality? And whether a profitable trading strategy exists between these two markets? The study finds that index spot and futures prices are integrated processes. Error correction models are developed and shown to be statistically significant in most cases and potentially useful for forecasting index spot and futures prices.

4.3 Findings and Results

The daily index of settlement values for the SET50 index and its associated SET50 index futures are plotted in Figure 4-1. The plot suggests that the two series are highly correlated implying a strong relationship.

Figure 4-1: The price movement of spot index and futures index during the sample period.



4.3.1 Descriptive Statistics

Before conducting the time series regression, the stationary property of the data must be considered. This can be done by using the ADF test, which stated in the previous section. Table 4-1 summarizes the key descriptive statistics of the series ln S_t (lnSpot) and ln F_t (lnFutures). Both series get the negative Skewness, and a bit positive Kurtosis. The Jarque-Bera probabilities absolutely confirm the results of non-normal distribution of the data.

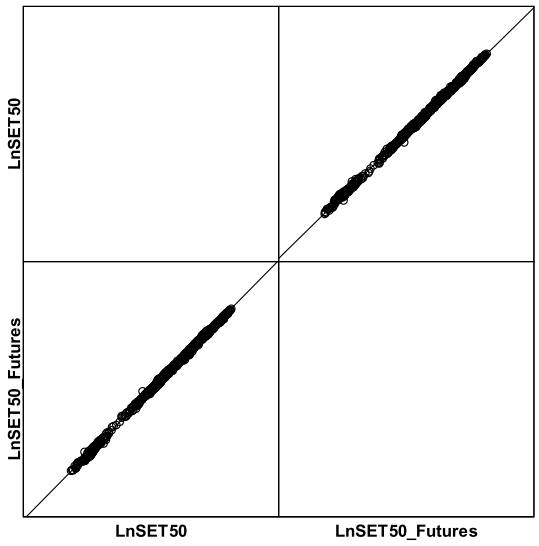
Table 4-1: Descriptive Statistics.

	ln S_t (lnSpot)	**ln F_t (lnFutures)**
Mean	6.26063	6.25633
Median	6.25830	6.25901
Maximum	6.68641	6.68773
Minimum	5.56567	5.55412
Std. Dev.	0.24473	0.24885
Skewness	-0.73095	-0.76629
Kurtosis	3.35194	3.40913
Jarque-Bera	124.73100	138.80810
Probability	0.00000	0.00000
Sum	8289.06900	8283.38600
Sum Sq. Dev.	79.23758	81.92593
Observations	1324.00	1324.00

Table 4-1 reports the descriptive statistics for each time series (spot index and futures index).

The scatter plot of figure 4-2 reveals the relationship or association between two variables and indicates that the higher the spot index at time t, the higher the futures index at time t. It appears sensible to summarize this relationship by drawing a straight line through the plot. From the graph you can see that there is a nearly linear relationship between the variables indicating that a linear regression model might be appropriate. Also, this figure can provide the answers that these two variables are related and the variation in one index change depending on another index. Hence, this figure is a useful diagnostic tool for examining association.

Figure 4-2: Scatter-plot matrix of lnspot and lnfutures index.



The null hypothesis (H_0) in this case is that there is no unidirectional from spot to futures index. The alternative hypothesis (H_1) is that there is unidirectional from spot to futures index. The assumptions of a linear regression model are made about the random component, which are the random component is assumed to be drawn from a distribution with mean 0 and constant standard deviation σ, it is assumed that ε is normally distributed; in this case, I used a large sample (1,324 observations) so this should be ok, and the random components of different observations are statistically independent; anyway this assumption may not valid for time-series data, where the random components of different observations can be expected to be correlated.

4.3.2 Correlation

To check the correlations between the SET50 index and SET50 index futures, the table below (Table 4-2**)** shows that there is a strong positive association between each two variables.

Table 4-2: Correlation.

		ln St (lnSpot)	ln Ft (lnFutures)
ln St (lnSpot)	Pearson Correlation	1	.999**
	Sig. (2-tailed)	0.000	0.000
	N	1324	1324
ln Ft (lnFutures)	Pearson Correlation	.999**	1
	Sig. (2-tailed)	0.000	0.000
	N	1324	1324

The Sig.(2-tailed) rows give the P-value for the test of the null hypothesis that the corresponding population correlation coefficient is zero. Here it is shown that the correlations of $\ln S_t$ with $\ln F_t$ variables are significantly different from zero. ** denote significant at the 0.01level (2-tailed).

The signs of the values of the correlations between $\ln S_t$ and $\ln F_t$ are positive which is related to the scatter plots that show the positive linear relationship (the regression line slopes upwards), where if one variable increases, the other one also increases. A positive correlation also exists in one decreases and the other also decreases. When looking at the Pearson Correlation, which measures the strength of the linear association or relationship between the two variables, it indicates that there is high correlation between the two variables (0.999). Hence, there is a strong positive association between these two variables.

4.3.3 Stationary Test

Table 4-3 shows the results of the ADF test for both series as in level form and first difference form. The models that used to construct the ADF test for both series are

also provided with lagged length included to yield serially uncorrelated residual term. For both series after considering the appropriate type of model as in Dickey and Fuller (1981), the random walk model is the best. Series $\ln S_t$ contains six lagged length in the model level form and five lagged length in the first different model. While $\ln F_t$ consists of seven lagged length in both level and first different form.

Table 4-3: Results of ADF tests in level and first difference form.

Level form

Coefficients	**$\Delta \ln S_t$**	**$\Delta \ln F_t$**
	ADF(6)	**ADF(7)**
$\hat{\alpha}$	1.76E-05	1.46E-05
	(0.225199)	(0.165443)
ADF test statistic: Prob*	0.7515	0.7341
Test critical value: 1% level	-2.566719	-2.56672
Test critical value: 5% level	-1.941064	-1.941064

* Mackinnon (1996) one-side p-values.

1st difference form

Coefficients	**$\Delta \ln S_t$**	**$\Delta \ln F_t$**
	ADF(5)	**ADF(7)**
$\hat{\alpha}$	-1.071807	-1.154067
	(-16.3378)	(-13.91183)
ADF test statistic: Prob*	0	0
Test critical value: 1% level	-2.566719	-2.566722
Test critical value: 5% level	-1.941064	-1.941064

* Mackinnon (1996) one-side p-values.

The values in parenthesis are the t-value for each parameter in the model. This value of the coefficient $\hat{\alpha}$ will be tested against the τ statistic value, and the null hypothesis (series contain a unit root) would be accepted if it is lower than the statistic value. The ADF test critical values according to type of model at 5% and 1% significant level are given at the bottom of the table.

The stats illustrate that both $\ln S_t$ and $\ln F_t$ are non-stationary at the level form. However, both are stationary after first difference, indicate that they are I(1). The Augmented Dickey-Fuller test statistic of $\ln S_t$ in the first difference form is equal to -16.3378, which is significant at 1% level. For the first difference form of $\ln F_t$, the Augmented Dickey-Fuller test statistic is -13.91183 states that it is significant at 1% level too. Thus, ADF test for both series reject the null hypothesis that the first difference form is non-stationary.

4.3.4 Cointegration Test

Since both series are all non-stationary and integrated of the same order (they are *I*(1)), so the cointegration test will be applied to examine whether these two series have a long-run relationship. The process will be managed as in the Engle and Granger (1987) methodology two-step tests and the cost of carry model. LR1 is the first approach that based on the Engle and Granger model and LR2 is the second approach that based on cost of carry model, these two approaches (LR1 and LR2) represent long-run equilibrium relationship between two time series (SET50 index futures and SET50 index).

For the LR1 or the long-run equilibrium relationship between SET50 index futures and SET50 index by using Engle and Granger model is given by the following equation.

$$\ln F_t = \theta_0 + \theta_1 \ln S_t + z_t \qquad (4.1)$$

$$\hat{z}_t = \ln F_t - \hat{\theta}_0 - \hat{\theta}_1 \ln S_t \qquad (4.2)$$

Where;

$\hat{z}_t$ = estimated residual of the long-run relationship

For the LR2 or the long-run equilibrium relationship between SET50 index futures and SET50 index by employing cost of carry model is given by the following equation.

$$F_t = S_t e^{[(r-d)T]_t} \qquad (4.3)$$

Where;

F_t = futures price, S_t = spot index

r = (short-term) risk free rate

d = dividend yield

T = time to maturity

Then transforming the above model by taking natural logarithm and obtain the result as below.

$$\ln F_t = \ln S_t + [(r-d)T]_t \qquad (4.4)$$

Thus, its cointegration error will be defined as

$$\hat{\lambda}_t = \ln F_t - \ln S_t - [(r-d)T]_t \qquad (4.5)$$

For sake of comparison, I will label the first approach that based on Engle and Granger two steps method as LR1 and the second approach that based on cost of carry model as LR2.

Table 4-4 below presents the cointegration equation as well as the ADF test for the cointegration error of each series for LR1 and LR2 approaches.

Table 4-4: Cointegration Test.

	Cointegration Equation	
	$\hat{\theta}_0$	$\hat{\theta}_1$
LR1	-0.105695	1.016197
T-Statistic	(-17.20097)	(1036.160)
ADF test statistic: Prob*	0	0

* Mackinnon p-values.

ADF test for the Cointegration Error ($\widehat{\mathcal{Z}_t}$and $\widehat{\lambda_t}$ *)		
Coefficients	**LR1**	**LR2**
	ADF(6)	**ADF(2)**
$\hat{\gamma}$	-0.142652	-0.026053
	(-6.312484)	(-4.06567)
ADF test statistic: Prob*	0	0.0001
Test critical value: 1% level	-2.566719	-2.566712
Test critical value: 5% level	-1.941064	-1.941063

* Mackinnon (1996) one-side p-values.

Both $\widehat{Z_t}$ and $\widehat{\lambda_t}$ generate a random walk model without drift and trend to be an appropriate model for the ADF test. The lagged length included in the model is determined by AIC value. The values in parenthesis are the t-value for each parameter in the model.

The Engle and Granger methodology is used to estimate a regression and to test the residuals for stationarity. As one would expect, there is a very strong relationship between ln S_t (lnSpot) and ln F_t (lnFutures) evidenced by a slope coefficient of around 1. Next, the results show that both cointegration errors from LR1 and LR2 are stationary[14] and the critical 1% significance value of $\widehat{Z_t}$ and $\widehat{\lambda_t}$ are -2.5667, so the null hypothesis of having a unit root is rejected. This means that ln S_t (lnSpot) and ln F_t (lnFutures) are cointegrated and have a long-run relationship between each other by applying both traditional linear model and cost-of-carry model.

4.3.5 Error-correction Model

The Granger representation theorem asserts that the short-run dynamic equilibrium of any two cointegrated time series data can be described by the error-correction model (ECM). Since I get the results where ln S_t and ln F_t are cointegrated, the ECM of these two can be constructed. In this part presents the estimation of the dynamic or short-run relationship, which has the disequilibrium terms from the above equation (LR1 and LR2). The procedure of this adjustment is called the error correction mechanism, which can be seen by the model below:

[14] The 1-month T-Bill and SET50 index market dividend yield were used in the calculation of LR2's short-term risk-free rate and dividend yield respectively.

$$\Delta \ln S_t = \beta_1' + \beta_2' \hat{e}_{t-1} + \sum_{i=1}^{n} \psi_i' \Delta \ln S_{t-i} + \sum_{i=1}^{n} \varphi_i' \Delta \ln F_{t-i} + \upsilon_t' \qquad (4.6)$$

$$\Delta \ln F_t = \beta_1 + \beta_2 \hat{e}_{t-1} + \sum_{i=1}^{n} \psi_i \Delta \ln S_{t-i} + \sum_{i=1}^{n} \varphi_i \Delta \ln F_{t-i} + \upsilon_t \qquad (4.7)$$

Where;

$\hat{e}_{t-1}$ = cointegration error

υ_t and υ_t' = white noise disturbance terms

These lag lengths can be determined by AIC value as in the unit root test. The important of the parameter β'_2 and β_2 is that one or both of them should be significantly different from zero if the variables are cointegrated. The absolute values of these two indicate the speed of adjustment from deviation in short run to the long-run equilibrium relationship.

For the rest of this research, the model that applies the cointegration error from LR1 will be called ECM1, while the model which applies the cointegration error from LR2 will be called ECM2.

Table 4-5 demonstrates the results of the models employing both LR1 and LR2 (the approach that based on Engle and Granger two steps method and the approach that based on cost of carry model) cointegration error, which are defined as ECM1 and ECM2 respectively.

Table 4-5: Error-correction Model.

	ECM1		ECM2	
	$\Delta \ln S_t$	$\Delta \ln F_t$	$\Delta \ln S_t$	$\Delta \ln F_t$
Constant	0.000134	0.000117	-0.000314	-0.000387
	(0.273414)	(0.213418)	(-0.522473)	(-0.574899)
$\hat{e}_{t-1}$	0.077250	-0.133704	0.002748	0.003081
	(1.260196)	(-1.950176)	(1.299433)	(1.301384)
$\Delta \ln S_{t-1}$	-0.051382	0.195258	-0.086919	0.254532
	(-0.580867)	(1.973629)	(-1.034168)	(2.705488)
$\Delta \ln F_{t-1}$	0.033430	-0.222306	0.071970	-0.285978
	(0.415379)	(-2.469751)	(0.962348)	(-3.416194)
Prob(F-statistic)	0.450427	0.000427	0.433324	0.001157
F-statistic	0.880728	6.060444	0.914231	5.349600

Table 4-5 provides the results of the error correction model that based on two approaches, which are Engle and Granger two steps method (ECM1) and Cost of Carry model (ECM2). The lagged term in each equation in this case equal to one lag for both $\Delta \ln S_t$ and $\Delta \ln F_t$.

The parameter of the cointegration error is insignificant for the equation were $\Delta \ln S_t$ is a dependent variable, while there is an evident trend in the equation were $\Delta \ln F_t$ is a dependent variable in ECM1 (t-statistic is -1.9502). The coefficients of the error correction term imply the response of the previous period's deviation into the long-run equilibrium. If the error-correction coefficient at time t-1 is positive that means the dependent variable is above its long run value. To correct itself, it is obvious that the dependent variable at time t should adjust downward. The same argument applies when the error-correction coefficient at time t-1 is negative or the dependent variable is below its long run value. With a positive error-correction coefficient, the

dependent variable adjusts downward the next period. With a negative error-correction coefficient it adjusts upward in the next period, indicating a move back towards equilibrium as shown in the equation were $\Delta \ln F_t$ is a dependent variable in ECM1. The coefficient should lie between 0 and 1, a 0 suggesting no adjustment one time period later while a 1 indicates full adjustment. The coefficient of -0.1337, suggests a 13.37% movement back towards equilibrium one period later. Moreover, the results show that for the $\Delta \ln F_t$ equation of both ECM1 and ECM2, all of the variables in the model are significant.

4.3.6 Lead-lag Relationship

After creating the ECM, now I can test the lead-lag relationship using the Wald test. The beginning of this practice is to write down the matrix R, β, and r conforming to the objective to find out such a lead-lag link. For ECM1 and ECM2, which have the same lagged length, this is simple to state as shown below.

Given that H(β) is an M ×1 vector linear function of β , the vector of parameters

So, $H(\beta) = R\beta - r$; where R is an M ×K coefficient matrix

r is an M ×1 constant vector

Hypothesis

H_0: Rβ - r = 0 or Rβ = r

H_1: Rβ - r ≠0 or Rβ ≠r

$$\mathbf{W}_{cal} = \frac{[\mathbf{R}\hat{\boldsymbol{\beta}} - \mathbf{r}]^{\mathrm{T}} \left[\mathbf{R}[\mathbf{X}^{\mathrm{T}}\mathbf{X}]^{-1}\mathbf{R}^{\mathrm{T}} \right]^{-1} [\mathbf{R}\hat{\boldsymbol{\beta}} - \mathbf{r}]}{\hat{\sigma}^2 M} \sim F(M, n-K) \qquad (4.8)$$

The null hypothesis will be accepted only if $W_{cal} < F(M, n-K)$, otherwise reject H_0. The restriction for equation (3.6) is formed to test whether lagged future prices has a power affecting the current spot index. For equation (3.7), the restriction is also formed to test in the other way (whether lagged spot index can affect to the current futures prices). The restriction will cover for both short-term effect and long-term effect represented by the coefficient of the other lagged variable in the equation and the coefficient of cointegration error. The results could be distinguished into four cases.

ECM1, ECM2: equation $\Delta \ln S_t$

H_0: $\beta_2' = 0$ and $\varphi_1' = 0$

$$\mathrm{R} = \begin{pmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}, \beta = \begin{pmatrix} \beta_1' \\ \beta_2' \\ \psi_1' \\ \varphi_1' \end{pmatrix}, \text{and } \mathrm{r} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$$

The calculated Wald stat for ECM1 and ECM2 is equal to 1.109552 and 1.237817 compare with 3.00 from the (3, 1315) degree of freedom and 95% confidence level F-stat table. This suggests that I cannot reject the null hypothesis at 5% level of significance. The leading effect of SET50 index futures to SET50 index is insignificant from this test for both models.

ECM1, ECM2: equation $\Delta \ln F_t$

H_0: $\beta_2 = 0$ and $\psi_1 = 0$

$$R = \begin{pmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{pmatrix}, \beta = \begin{pmatrix} \beta_1 \\ \beta_2 \\ \psi_1 \\ \varphi_1 \end{pmatrix}, \text{and } r = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$$

The Wald statistic value from this restriction for ECM1 is 5.981429 and 5.779002 for ECM2 compare with F-stat from the table, which is 3.00 where (1-α) confidence level is 95% and degree of freedom is (3, 1315). This means that the null hypothesis is rejected at 5% level of significance. Logarithm of SET50 index does have a lead effect on the logarithm of SET50 index futures in terms of short-run and long-run relationship for both models.

Table 4-6. Wald Test.

		ECM1		**ECM2**	
Test Statistic	**Df**	**$\Delta \ln S_t$**	**$\Delta \ln F_t$**	**$\Delta \ln S_t$**	**$\Delta \ln F_t$**
F-Statistic	(3,1315)	1.109552	5.981429	1.237817	5.779002
Chi-Square	3	3.328656	17.94429	3.713452	17.337
F-Stat (Prob)		0.3441	0.0005	0.2946	0.0006

Table 4-6 presents the results of the Wald test for each equation. There are four equations in this case; the first equation is the equation that based on Engle and Granger and $\ln S_t$ is a dependent variable, the second equation is the equation that based on Engle and Granger and $\ln F_t$ is a dependent variable, the third equation is the equation that based on Cost of Carry model and $\ln S_t$ is a dependent variable, and the fourth equation is the equation that based on Cost of Carry model and $\ln F_t$ is a dependent variable,

The results from this test guide me to the conclusion that the spot index has a

unidirectional leading power over the futures index on a daily basis. This is consistent to many papers argue that spot lead futures index such as findings by Lucian (2008), Bohl, Salm and Wilfling (2009), Cabrera, Wang and Yang (2009), Chen and Gau (2009), and Yang, Yang and Zhou (2012).

The findings of this paper; however, show that lead-lag effect between spot index and its futures contract last for at least two days. This may be implied that the new market wide information are disseminated and influence on the spot market before the futures index movement for at least two days.

4.3.7 Robustness Check using TDEX

All the above processes exercise the SET50 index as an underlying to the SET50 index futures. However, as the robustness check, ThaiDex SET50 Exchange-Traded Fund or TDEX could be used in this purpose as it is highly correlated with SET50 index (see Figure 4-3). The lead-lag investigation between SET50 index futures and ThaiDex SET50 Exchange-Traded Fund (TDEX) instead of SET50 index in this paper is mainly arisen from the argument that the lead-lag effect can be explained largely by the transaction costs. The Exchange-Traded Fund (ETF) mimics return in SET50 index can be viewed as an instrument that investors can even trade easily or diversify their portfolio as in the core and satellite strategy; absolutely, by a short amount of transaction fees.

Hence, it is meaningful to examine the lead-lag relationship between TDEX and SET50 index futures and compare the result when using SET50 index as in the

preceding process. Since cost-of-carry model has just intended for the no-arbitrage equilibrium between futures and spot index, the lead-lag relationship of TDEX will be investigated through a linear model only. The consequence of this comparison can hint us regarding to the reason whether it exists a lead-lag relationship between spot and futures in Thai market.

Figure 4-3: The price movement of SET50 index and TDEX in the trading period.

Table 4-7 reports the results of the unit root test (the ADF test) in level form and first difference form. The model that used to construct the ADF test is also provided with lagged length included to yield serially uncorrelated residual term. After testing the appropriate type of model as in Dickey and Fuller (1981), the random walk model is the appropriate one. Series $\mathbf{ln\ TD_t}$ contains fifteen lagged length in the model level form and one lagged length in the first different model.

Table 4-7: Results of ADF tests in level and first difference form.

Level form

Coefficients	**$\Delta \ln TD_t$**
	ADF(15)
$\hat{\gamma}$	-0.000065
	(-0.19462)
ADF test statistic: Prob*	0.6161
Test critical value: 1% level	-2.56733
Test critical value: 5% level	-1.94115

* Mackinnon (1996) one-side p-values.

1st difference form

Coefficients	**$\Delta \ln TD_t$**
	ADF(1)
$\hat{\gamma}$	-0.954881
	(-30.06603)
ADF test statistic: Prob*	0
Test critical value: 1% level	-2.56733
Test critical value: 5% level	-1.94115

* Mackinnon (1996) one-side p-values.

The values in parenthesis are the t-value for each parameter in the model. This value of the coefficient $\hat{\gamma}$ will be tested against the τ statistic value, and the null hypothesis (series contain a unit root) would be accepted if it is lower than the statistic value. The ADF test critical values according to type of model at 5% and 1% significant level are given at the bottom of the table.

The stats illustrate that $\mathbf{\ln TD_t}$ is non-stationary at the level form. However, it is stationary after first difference, indicate that it is I(1). The Augmented Dickey-Fuller test statistic of $\mathbf{\ln TD_t}$ in the first difference form is equal to -30.0660, which is

significant at 1% level. Hence, the ADF test for this time series reject the null hypothesis that the first difference form is non-stationary.

Table 4-8 presents the cointegration test, since both futures index and TDEX are integrated of the same order as they both are I(1), so the cointegration test will be employed to investigate whether these two time series have a long-run relationship. The process for testing will be managed as in the Engle and Granger (1987) methodology.

Table 4-8: Cointegration test for TDEX.

	Cointegration Equation	
	$\hat{\theta}_0$	$\hat{\theta}_1$
	4.51031	1.047849
T-Statistic	(1886.084)	(744.6037)
ADF test statistic: Prob*	0	0

* Mackinnon p-values.

ADF test for the Cointegration Error ($\hat{\zeta}_t$)	
Coefficients	**ADF(9)**
$\hat{\gamma}$	-0.083481
	(-4.023177)
ADF test statistic: Prob*	0.0001
Test critical value: 1% level	-2.56733
Test critical value: 5% level	-1.94115

* Mackinnon (1996) one-side p-values.

The values in parenthesis are the t-value for each parameter in the model.

The Engle and Granger methodology is used to estimate a regression and to test the residuals for stationarity. As one would expect, there is a very strong relationship between $\ln TD_t$ and $\ln F_t$ evidenced by a slope coefficient of around 1. For series $\ln TD_t$, the natural logarithm of series TDEX, the appropriate model in this case is a random walk model without drift and trend. The ADF test result shows that it is stationary. The critical 5% level of significance for τ statistic in this case is -1.94115, so the unit root null hypothesis is rejected. The ADF test for the residual obtained from a regression between $\ln TD_t$ and $\ln F_t$ proves that both series are cointegrated. The series of cointegration error ($\hat{\boldsymbol{\zeta}}_t$) is obtained from the residual of the equation where I run series $\ln F_t$ as a dependent variable and series $\ln TD_t$ as an independent variable. The t-value from the estimated parameter is equal to -4.023177 indicates that the null hypothesis for unit root is rejected. The random walk without drift and trend is used as a model in this case.

Table 4-9 presents the error-correction model for TDEX. To be as consistent as the test between SET50 index and SET50 index futures, the in-sample period would be since the inception of TDEX, which is September 6, 2007 until September 30, 2011 the same ending month as in the previous test, though number of observation is different.

Table 4-9: Error-correction model for TDEX.

	$\Delta \ln TD_t$	$\Delta \ln F_t$
Constant	0.0000871	0.0000936
	(0.152952)	(0.139874)
$\hat{\zeta}_{t-1}$	0.061096	-0.028795
	(1.181558)	(-0.485593)
$\Delta \ln F_{t-1}$	-0.03577	0.378818
	(-0.33641)	(3.401846)
$\Delta \ln TD_{t-1}$	0.064755	-0.364371
	(0.698068)	(-3.790664)
$\Delta \ln F_{t-2}$	-0.110493	
	(-1.123099)	
$\Delta \ln TD_{t-2}$	0.149175	
	(1.718438)	

The method to construct the ECM is the same as previous and recommended for two lagged length. The error correction term is significant just only in $\Delta \ln TD_t$ equation. This can be implied that the deviation in the short run period will be corrected into the long-run relationship by adjusting series $\ln TD_t$. The lead-lag relationship is tested by using the Wald test as follows.

Suppose the Error-correction model for TDEX is

$$\Delta \ln TD_t = \mu_1' + \mu_2' \hat{\zeta}_{t-1} + \sum_{i=1}^{m} \pi_i' \Delta \ln F_{t-i} + \sum_{i=1}^{m} \eta_i' \Delta \ln TD_{t-i} + \xi_t' \qquad (4.9)$$

$$\Delta \ln F_{\mathrm{t}} = \mu_1 + \mu_2 \hat{\zeta}_{t-1} + \sum_{i=1}^{m} \pi_i \Delta \ln F_{t-i} + \sum_{i=1}^{m} \eta_i \Delta \ln TD_{t-i} + \xi_t \qquad (4.10)$$

ECM: equation $\Delta \ln TD_t$

H_0: $\mu_2' = 0$ and $\pi_1' = 0$

$$\mathrm{R} = \begin{pmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{pmatrix}, \beta = \begin{pmatrix} \mu_1' \\ \mu_2' \\ \pi_1' \\ \eta_1' \end{pmatrix}, \text{and r} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$$

The Wald statistic is 0.543526 compare with the critical 5% value from F-stat (2, 983), which is 3.00. The null hypothesis cannot be rejected at 5% level of significance denote that there is no leading effect from SET50 index futures to TDEX.

ECM: equation $\Delta \ln F_t$

H_0: $\mu_2 = 0$ and $\eta_1 = 0$

$$\mathrm{R} = \begin{pmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}, \beta = \begin{pmatrix} \mu_1 \\ \mu_2 \\ \pi_1 \\ \eta_1 \end{pmatrix}, \text{and r} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$$

The Wald statistic is 12.86998 compare with 3.00 the critical value. The null hypothesis is rejected regarding to the level of significance at 5%. Logarithm of TDEX does have a lead effect on the logarithm of SET50 index futures in terms of short-run and long-run relationship for both models.

The results point out that there is a causal relationship between SET50 index futures and TDEX.

4.3.8 Forecasting Accuracy

The forecasting evaluation is conducted in the out-of-sample data and predicted one step ahead using the most updated information at the time. As I know from the lead-lag relationship test that the spot index leads futures contract, so the equation of interest here is the $\Delta \ln F_t$ equation from both ECM1 and ECM2. The results of RMSE, MAE, MAPE, and percentage of correct direction forecast are summarized and shown below in table 4-10.

$$RMSE = \sqrt{\frac{\sum_{i=1}^{n}(y_i - \hat{y}_i)^2}{n}} \quad (4.11)$$

$$MAE = \frac{1}{n}\sum_{i=1}^{n}|y_i - \hat{y}_i| \quad (4.12)$$

$$MAPE = \frac{1}{n}\sum_{i=1}^{n}\left|\frac{y_i - \hat{y}_i}{y_i}\right| \quad (4.13)$$

Where; y_i = actual value, and $\hat{y}_i$= forecasting value

Table 4-10: Comparison of out-of-sample forecast for $\Delta \ln F_t$

	ECM1	**ECM2**
RMSE	0.0151	0.0153
MAE	0.0109	0.0110
MAPE (%)	6.5515	10.6916
Correct Direction (%)	61.73	54.94

Table 4-10 provides the results of Root Mean Square Error (RMSE), Mean Absolute Error (MAE), Mean Absolute Percentage Error (MAPE), and Percentage of Correct Direction. The model that yields the lowest RMSE, MAE, and MAPE and the highest correct predicted direction will be the best model and will be chosen to be utilized in the trading strategy.

The forecasting performance for the two ECM is quite similar. However ECM1 yields better result than ECM2, which applied the Cost-of-Carry relationship in the model. It correctly predicts direction of SET50 index futures movement 61.73% of the time and gets lower RMSE, MAE, and MAPE than ECM2. As suggested by Leitch and Tanner (1991) that the models, which can accurately forecast the sign of future returns, or can predict a turning point have been found to be more profitable, therefore the ECM1 would be used in the next section where the trading strategy is created.

4.3.9 Trading Strategy

Since one of the main motivations of this research paper is to develop a trading strategy based on the ECM, thus the first step is to find out the ECM that has the most predictive ability; in this case, model ECM1 is used in a trading strategy and compare the returns with the passive buy-and-hold strategy in the SET50 index.

The trading period will be from October 1, 2011 until May 30, 2012 including 162 observations. The buy-and-hold strategy benchmark is calculated from the SET50 Total Return Index. The SET50 TRI will be reckoned for the continuous return given that I hold the index since the beginning of the trading period until the last day.

The gross return and net return are also provided given the transaction costs. The ECM1 give the one step ahead forecasts based on a daily basis. The transaction costs involve here are commission fee 0.1% per one trading trip whether it is buy or sell, and value added tax 7% on the commission fee. Because there is no dividend payout in the trading period, the dividend effect can be excluded from the considerations. The bid-ask spread costs are also ignored to simplify the calculation.

It is assumed that the original investment is 1,000 baht and is accumulated over a trading period. The investors will trade by using the cash account with the broker. Interest rate 1% p.a. excluding the withholding tax will be included in the net return as a risk-free benefit when there is no position opened. This number comes from the interest paid by the broker to any customers in the cash account. No short selling is executed in the trading strategy as well.

4.3.9.1 The Strategy: Buy Predicted Positive and Sell Predicted Negative

This strategy triggers buying order for the closing price of day t+1 when the predicted $\Delta \ln F_{t+1}$ value is positive and requires investors to hold this position until the predicted $\Delta \ln F_{t+1}$ is negative then sell all the position held at the closing price of day t + 1.The reason why I buy or sell at the closing price is that the data used to construct the model are the closing price daily observations. The buying/selling orders can be sent via the ATC (at the close) order. This type of order will be matched firstly before any type of order at the closing price of that day. If the predicted $\Delta \ln F_{t+1}$ still be negative, the position will not be opened and in this case

earns the risk free rate 1% p.a. The intuition behind this strategy is based on the notion of momentum for the price movement. I would like to capture the first reversal from a negative return to be a positive return and believe that this positive return still be last for a while as the price has a momentum. This concept is substantial useful and widely accepted especially in the rising market.

4.3.9.2 The Trading Profits: Gain or Loss?

Table 4-11 illustrates the returns of the trading strategy as well as the buy-and-hold benchmark returns. Gross return is the return where exclude all the transaction costs, while net return includes this into account.

Table 4-11: Trading Strategy Returns.

	Passive Buy and Hold	**Trading Strategy**
Gross Return (Baht)	194,500	326,480
Gross Return (%)	389	652.96
Net Return (Baht)	193,500	290,480
Net Return (%)	387	580.96
Number of Trade	1	36
Gain	1	24
Loss	-	12

Investigate through the results; the trading strategy also generates the positive return as well as the benchmark return. The benchmark buy-and-hold strategy result gives us some sense that the stock returns on the trading period are very bullish. People who buy the index and hold it in this trading period will end up with his gain around

387 percent. The trading strategy's return after transaction costs looks excellent, and the number of gain trading trips is twice as the loss. Moreover, its net return still beats the benchmark return around 194 percent. In summary, the results prove to be quite well since the trading strategy can outperform the market benchmark and it can be implied that the Thai market has some profit taking opportunities left. There are some caveats since the trading strategy involves some assumption embedded, i.e. the trading lot assumption. Thus, the results can be different in the practical manner regarding to the actual trading. Nonetheless, even if the trading strategy contains some assumptions, but this finding also useful in explaining the characteristic of the financial market in Thailand compare with the other markets which were studied a lot in other research papers.

4.4 Summary and Conclusion

In a perfectly functioning financial market, every piece of information should be reflected simultaneously in the underlying spot market and its derivatives markets. However, in reality, information can be disseminated in one market first and then transmitted to other markets due to market imperfections. This research has examined the relationship between the spot index and the futures index of the Thailand Stock Market and Thailand's derivatives market (SET50 index and SET50 index futures) during the period 2006 to 2012. A trading strategy was constructed based on the error-correction model and the lead-lag connection between spot and futures index. In order to find the profitable strategy, the best error correction model in term of forecasting power was used.

The stationary test results provided evidence that both the selected markets were stationary. Hence, the Granger causality test was followed. The findings of this research indicate that SET50 index lead SET50 index futures, the results are supported by evidence from several studies; for example, Gee and Karim (2005) analyzed the lead-lag relationship by using daily data between index futures and spot index but specifically in the Malaysian market. The error-correction model was used as the model to test for this relationship. They discovered that the spot index could lead futures price. Moreover, Lucian (2008) investigated the way price discovery works in the Romanian markets by using both cash and futures markets. The results indicated that the Romanian cash market leads the futures market by three to five minutes, when new information emerges, it is integrated in the two markets with different speeds, depending upon the characteristics of the markets and the investors involved. Bohl et al. (2009) investigated the impact of index futures on the underlying stock market by employing a Markov-switching-GARCH approach; they found that in spot market lead futures market in Poland. Furthermore, Cabrera et al. (2009) also investigated the price discovery of Euro and Japanese Yen exchange rates in three foreign exchange markets based on electronic trading systems: the CME GLOBEX regular futures, E-mini futures, and the EBS interdealer spot market. The results show that the spot market is found to consistently lead the price discovery process for both currencies during the sample period.

The results are consistent with many studies that find that the spot market leads futures market and this lead-lag relationship will be disappeared when transaction costs are reduced. Additionally, the reflection of new market wide information in the spot stock market is faster than in the futures market. The best forecasting model

using root mean squared error (RMSE), mean absolute error (MAE), and percentage of correct direction criterions is the traditional error correction model (ECM) where the cointegration error term came from the simple linear regression (ECM1). It can correctly predict direction of the futures index movement by 61.73% and yield the lowest RMSE and MAE relative to the other model. With the trading strategies based on the ECM1, it can beat the market return by getting around 194 percent above its benchmark along the eight months trading period after transaction costs.

The results from this paper can be extended further. An interesting question is whether this lead-lag relationship between spot index and futures contract would exist if the market were bigger and more mature. Separation of the periods to find if the result is still consistent is one appropriate way when the data from the futures market are larger. The trading strategy can be developed further in order to find the most realistic strategy that can consistently outperform the market. One might investigate what the return of the strategy in this paper looks like when the market is falling or rising.

Chapter 5. Empirical Analysis and Results

"How different types of investors behave between spot and futures market in an emerging market: New empirical evidence from Thailand."

5.1 Introduction

Several researches in economics have been built on the notion that human beings are rational agents who attempt to maximize wealth while minimizing risk. These agents carefully assess the risk and return of all possible investment options to arrive at an investment portfolio that suits their level of risk aversion. Models based on these assumptions yield powerful insights into how markets work. However, some empirical researches indicate that in reality, real individual investors behave differently. A number of researches show that both momentum and contrarian investor behavior may arise and be sustained in a financial market.

This chapter focuses on the empirical investigation of one of the research questions; it presents the findings and analysis on the trading patterns of various investor types. Section 5.2 examines the background of this research questions. Section 5.3 presents and discusses the empirical results. Section 5.4 summarizes the main finding of the chapter.

5.2 Background

There is an ongoing debate whether the market is efficient. The Efficient Market Hypothesis has been regarded as a model so far, when the hypothesis was stated by Fama (1970). This theory states that the rational behavior was proceed by the rational investors in the securities market and the investors' decision was built on the expected theory. However, plenty of empirical studies indicate that the investors' behavior do not match the traditional theory in the real situation. Moreover, investors usually make decisions with overconfidence, overoptimistic and cognitive biases, which generate the result is not the optimal decision-making in the true life.

Many literatures continue to debate whether investor trading decisions are influenced more by information about value or by psychological biases. Two categories of theoretical trading models have been developed to explain the two potential influences of behavior. The information-based category of models posits that trading is based on informational advantages. These models suggest that informed investor trading would exhibit a positive feedback, or momentum, pattern of trading. The behavioral-based models posit that investor decisions are influenced by cognitive errors such as overconfidence and disposition effect. There is a large body of literature empirically documenting the predictability of stock returns which give rise to the profitability of two distinct investment strategies (contrarian and momentum), take for example, DeBondt and Thaler (1985, 1987) and many other researchers[15]

[15] The body of empirical studies relating to the contrarian strategy is large. To cite some, see Lakonishok et al. (1992), Brennan and Cao (1997), Grinblatt and Keloharju (2000), Griffin et al. (2003), Richards (2005), Ng and Wu (2007), Li et al. (2010), Bae et al. (2011), Kaniel et al. (2012), and Birru (2015).

showed that mean-reversion in stock returns is so predictable that investors can beat the market with the momentum or contrarian strategy.

There are many anomalies identified in historical stock returns such as the contrarian and momentum effect, which has caught much attention in the finance and economics research. Many anomalies which could not explained by the traditional theory; therefore, the behavior finance theory was developed based on the psychology and attempt to explain these anomalies; Kahneman and Tverskey (1979) state that investors are unable to make decision with adequate and available information rather than like the individual was described in the EMH who will do complete analysis to all situations. They think most people has cognitive bias and makes decision based on the rule of thumb. In fact, investors' decisions will depend on their psychological factors, the environment or the error news so that the market is not perfect as the efficient market; it implies that there are arbitrage chances in the market. Two investment-related anomalies are momentum and contrarian strategy.

Momentum strategy states that the stock will continue to rise or continue to decline in the short term so that buying the past winner and selling the past loser; contrarian strategy is contrary, which means the price will adjust reverse so that buying the past loser and selling the past winner. The views of the two strategies are the former means the existence of the underreaction, the latter means the existence of the overreaction.

Since Jegadeesh and Titman (1993) state the momentum strategy and the De Bondt and Thaler (1985) state the contrarian strategy, many researchers who began to study

the source of the abnormal return in order to examine whether if the profitability exist or not. . For instance, Odean (1999) finds contrarian tendency of individual investors' behavior in the U.S. Grinblatt and Keloharju (2000) examine investment strategies of different investor types in Finland and find individuals and institutions follow contrarian trading strategies while foreigners follow momentum investment strategies. Lin and Swanson (2003) find that foreign investors in Taiwan employ momentum trading strategies. Richards (2005) indicates that individual investors in Asian equity markets follow contrarian trading, Cai and Zheng (2004) present momentum trading of institutional investors in US.

While theory suggests that investor trading may be characterized by specific trading patterns, empirical studies can identify the actual trading patterns of investor groups. In addition, a number of recent literatures show that both momentum and contrarian investor behavior may arise and be sustained in a financial market. The purpose of this study is to empirically characterize the trading style of different investor groups in Thailand in both spot and futures market. To be consistent with theoretical models, I look for the positive and negative feedback trading patterns.

5.3 Findings and Results

Table 5-1 summarizes the sample statistics of NIF of each type of investors in Stock Exchange of Thailand (Thailand's spot market) and Thailand's Derivative Market (Thailand's futures market). The NIF will be positive (negative) when the investor group buys more (less) equities than sells during the week. The large net buying

(selling) signals that the investors think the SET index is undervalued (overvalued) relative to the alternatives.

5.3.1 Descriptive Statistics

Table 5-1: Summary statistics of daily net investment flow (unit: Million Baht).

	Foreign Investors	**Institutional Investors**	**Individual Investors**
Mean	0.011271	-0.005598	-0.001656
Median	0.011657	-0.003843	-0.001332
Maximum	0.552346	0.312934	0.214916
Minimum	-0.35153	-0.310973	-0.360116
Std. Dev.	0.129337	0.09852	0.067835
Skewness	0.260662	0.078126	-0.485802
Kurtosis	4.329502	3.599914	5.903494
Jarque-Bera	36.96328	6.965651	169.909
Probability	0	0.03072	0
Sum	4.903014	-2.435008	-0.720418
Sum Sq. Dev.	7.259988	4.212491	1.997081
Observations	435	435	435

Tabel 5-1 reports the descriptive statistics for each investor group on a daily basis. The Net Investment Flow (NIF) is computed as $NIF_{it} = (Buying_{it} - Selling_{it})/(Buying_{it} + Selling_{it})$ for each investor type *i* during day *t*.

In spot stock market, foreign investors were net buyers during the sample period with an average NIF of 0.011271. In term of variation of net buying and selling, the standard deviation of 0.129337 indicates that they ranked first among the all investor groups. They have large swings in investment flow with a large net selling of -0.35153 one day and a large net buying of 0.552346 in another day. Institutional investors were net sellers with an average NIF of -0.005598. The standard deviation of the NIF for individual investor was 0.09852, this was the second highest among these three investor groups. Their minimum and maximum NIFs were -0.310973 and 0.312934 respectively. Individual investors, the largest trading groups on the SET index during the sample period, were a net seller of equities with an average NIF of -0.001656. Their variation of net investment flow was 0.067835; additionally, measuring variation by using the minimum and maximum trading imbalance shows that -0.360116 and 0.214916 are also the lowest of the groups.

Table 5-2: Summary statistics of daily net investment flow (unit: Contracts).

	Foreign Investors	**Institutional Investors**	**Individual Investors**
Mean	0.008149	-0.003495	-0.000332
Median	-0.0003	-0.003322	0.002376
Maximum	0.832677	0.294477	0.18337
Minimum	-0.670192	-0.270291	-0.225304
Std. Dev.	0.278735	0.077728	0.061368
Skewness	0.157607	0.040542	-0.23578
Kurtosis	3.040933	3.905846	3.615157
Jarque-Bera	1.83127	14.99176	10.88926
Probability	0.400262	0.000555	0.004319

Sum	3.544838	-1.520112	-0.144215
Sum Sq. Dev.	33.71874	2.622093	1.634479
Observations	435	435	435

Table 5-2 reports the descriptive statistics of daily Net Investment Flow (NIF) for each type of investor. The NIF is computed as $NIF_{it} = (Buying_{it} - Selling_{it})/(Buying_{it} + Selling_{it})$ for each investor group *i* during week *t*.

In futures market, foreign investors were also net buyers during the sample period as in spot market with an average NIF of 0.008149 and their standard deviation of 0.278735 show that they ranked the first among all investor groups and have large swings. Institutional investors and individual investors were net seller with an average NIF of -0.003495 and -0.000332 respectively.

5.3.2 Augmented Dickey-Fuller (ADF) Tests

Table 5-3 and Table 5-4 show the results of the ADF test for all series in level form in both spot and futures market. The models that are used to construct the ADF test for all series are also provided with lagged length included to yield serially uncorrelated residual term. For these three series (foreigns, institutionals, and individuals), each series has to test for the stationary property by employing the Augmented Dickey Fuller (ADF)[16] test, which can be estimated under three different forms, which are random walk, random walk with drift, and random walk with drift

[16] See, for example, Dickey and Fuller (1981)

and trend respectively. After testing by using the methods provided in Dickey and Fuller (1981) to find the appropriate type of model, the results show that the random walk model is the appropriate model. For the random walk model, it assumes that, at each point in time, the series merely takes a random step away from its last recorded position, with steps whose mean value is zero.

Table 5-3: Results of Augmented Dickey-Fuller (ADF) tests in spot market.

Coefficients	ΔForeigns	ΔInstitutions	ΔIndividuals
$\hat{\alpha}$	-0.470119***	-0.63334***	-0.600417***
	(-9.562561)	(-9.306139)	(-11.08498)
$\hat{\beta}_1$	-0.106924**	-0.135355**	-0.053594
	(-2.231734)	(-2.245285)	(-1.116997)
$\hat{\beta}_2$		-0.115927**	
		(-2.422543)	

Table 5-4: Results of Augmented Dickey-Fuller (ADF) tests in futures markets.

Coefficients	ΔForeigns	ΔInstitutions	ΔIndividuals
$\hat{\alpha}$	-0.686617***	-0.868649***	-0.908301***
	(-11.52667)	(-18.23026)	(-18.99452)
$\hat{\beta}_1$	-0.113882**		
	(-2.386059)		
$\hat{\beta}_2$			

Table 5-3 and Table 5-4 report the results of the ADF test in the spot market and the futures market in Thailand. The values in parenthesis are the t-value for each parameter in the model. This value of the coefficient $\hat{\alpha}$ will be tested against the τ statistic value, and the null hypothesis (series contain a unit

root) would be cannot rejected if it is lower than the statistic value. The ADF test critical values according to type of model at 10%, 5% and 1% significant level are given at the bottom of the table.

* Denotes significance at the 10% level.

** Denotes significance at the 5% level.

*** Denotes significance at the 1% level.

The statistics illustrate that these series are stationary at the level form. In spot stock market, series of foreign and individual have one-lagged length in the model level form, while institution series consist of two-lagged length in level form. For futures market, the results show that series of foreign contain one-lagged length, whereas series of institution and individual have no lag.

The Augmented Dickey-Fuller test statistics of foreign in the level form of spot market and futures market are equal to -9.562561 and -11.52667 respectively, which is significant at 1% level. For the level form of institution and individual, the Augmented Dickey-Fuller test statistic in spot market are -9.306139 and -11.08498, respectively, which states that they are significant at 1% level too. Moreover, the ADF statistic value of futures market in level form of institution and individual are -18.23026 and -18.99452, which indicates that they are also significant at 1% level. Therefore, ADF test for all series in both spot and futures market reject the null hypothesis that the level form is non-stationary.

5.3.3 Correlation

Table 5-5: Correlation of daily net investment flow of all types of investors in spot market.

	Foreigners	Individuals	Institutions
Foreigners	1	-0.755596	-0.146696
Individuals	-0.755596	1	-0.488655
Institutions	-0.146696	-0.488655	1

Table 5-6: Correlation of daily net investment flow of all types of investors in futures market.

	Foreigners	**Individuals**	**Institutions**
Foreigners	1	-0.682824	-0.173786
Individuals	-0.682824	1	-0.45919
Institutions	-0.173786	-0.45919	1

Table 5-5 and Table 5-6 report the Pearson Correlation Coefficients of all investors types in both spot and futures market.

When looking at the Pearson Correlation, which measures the strength of the linear association or relationship between the two variables, the results show that there is a correlation between the two variables. Take for example, the correlation table shows that the correlation between foreigners and individual in spot and futures market are -0.755596 and -0.682824 respectively, which means there are strong negative associations between these variables.

Table 5-7: Correlation of daily net investment flow and the return of SET in spot market.

	Foreigners	Individuals	Institutions
Foreigners	1	-0.75613	-0.147283
Individuals	-0.75613	1	-0.487342
Institutions	-0.147283	-0.487342	1
SET Return (t=-2)	0.146184	-0.05698	-0.071996
SET Return (t=-1)	0.367053	-0.323167	0.041717
SET Return (t=0)	0.308156	-0.615754	0.558284
SET Return (t=1)	0.091222	-0.101478	0.037047
SET Return (t=2)	0.067362	-0.077286	0.020001

Table 5-8: Correlation of daily net investment flow and the return of SET futures in futures market.

	Foreigners	Individuals	Institutions
Foreigners	1	-0.680259	-0.177571
Individuals	-0.680259	1	-0.458619
Institutions	-0.177571	-0.458619	1
SET Futures Return (t=-2)	0.048565	0.043806	-0.13689
SET Futures Return (t=-1)	0.199134	-0.109733	-0.082597
SET Futures Return (t=0)	0.349948	-0.239783	-0.060967
SET Futures Return (t=1)	0.052461	-0.088288	0.048945
SET Futures Return (t=2)	0.079444	-0.023254	-0.048735

Table 5-7 and Table 5-8 present Pearson correlation coefficients are reported between each investor type's net investment flow and market returns. Return is a daily return of the SET and SET futures for the preceding, the next, and the day of the investment flow.

The results from table 5-7 and table 5-8 show the correlation between the net investment flow (NIF) and daily market returns (SET return). The return of SET represents the daily return of the SET index of the investment flow at time t = 0, the previous days (t =-1, and -2) and the next days (t =1, and 2). These tables report that in both spot and futures market foreign investors' NIF is significantly negatively correlated with institutional and individual investors. Individual investors' trade flow is negatively correlated with institutional traders' investment flow.

For feedback trading pattern, which is correlation between each investor's trade flow (NIF) and the SET return or the SET futures return. A positive (negative) correlation between trade flow and market return during the previous weeks indicates that the group is positive (negative) feedback trading. Feedback trading is also known as either contrarian investing when the trade imbalance is negatively correlated with past return or momentum investing when the correlation is positive.

The results above show that in both spot market and futures market of Thailand, foreign investors trade flow is significantly positively correlated with the SET return/SET futures return during the day of the trading (t = 0). The estimates for correlation on returns during the previous (t = -1, and -2) and next day (t = 1, and 2) are also significantly positive. This suggests that foreign investors are positive feedback or momentum traders.

Individual investor net investment flow in both spot and futures market is significantly negatively correlated with the market return on current, past, and future trading day. That is, individual investors tend to be contrarian investors, or negative

feedback traders. While, institutional investors' trading pattern in both spot and futures market is rather mixed results in different day. For example, in spot market, in day t=0, they exhibit positive feedback trading patterns or momentum traders but correlations on returns during the previous day (t=-2) shows that they employ a negative feedback or contrarian trading strategy.

5.3.4 Vector Autoregresstion (VAR) Model

Since the investor group's NIF is correlated with both past flow and past returns, then it is need to be cautious in the interpretation of the results. That is, multicollinearity may cause erroneous conclusions. To account for this problem, I investigate trading patterns by estimating a simple bivariate VAR(p) model. Specifically, I propose the VAR model:

$$I_{i,t} = \alpha + \sum_{\tau=1}^{p} \beta_i R_{t-\tau} + \sum_{\tau=1}^{p} \lambda_i I_{i,t-\tau} + \sum_{\tau=1}^{p} \gamma_i I_{j,t-\tau} + \varepsilon_{i,t} \qquad (5.1)$$

where R_t is the SET index return for day t, $I_{i,t}$ is a vector of net investment class flows (NIF) of investor type i for day t, $I_{j,t}$ is a vector of net investment flows of another investor type j for day t, and $i \neq j$, and i and j represent type of investor; foreign, institutional, or individual investors. Besides, α is a matrix of constants, β_i, λ_i, and γ_i are matrix of parameters, and $\varepsilon_{i,t}$ is the error matrix. The estimation results are reported in Table 5-9 and 5-10.

Table 5-9: VAR model estimates of net investment flow and SET return.

	NIF (t=0)		
	Foreigners	**Institutions**	**Individuals**
NIF: Foreigners			
t=-1	0.31066**	-0.137516	-0.011428
	(2.035748)	(-1.053906)	(-0.131579)
t=-2	0.316872**	-0.144339	-0.09456
	(2.128835)	(-1.134107)	(-1.116229)
NIF: Institutions			
t=-1	0.056453	0.210539*	-0.041164
	(0.372573)	(1.625067)	(-0.477346)
t=-2	0.174793	-0.037824	-0.096062
	(1.169586)	(-0.296001)	(-1.129392)
NIF: Individuals			
t=-1	-0.134424	-0.043721	0.216946
	(-0.421533)	(-0.160347)	(1.195342)
t=-2	0.386999	-0.407495	-0.043853
	(1.221037)	(-1.503667)	(-0.243112)
SET Return			
t=-1	2.23874***	-0.391292	-0.83355**
	(3.366787)	(-0.688214)	(-2.202568)
t=-2	-0.522625	-1.014963*	0.813157**
	(-0.789269)	(-1.792651)	(2.157721)

Table 5-10: VAR model estimates of net investment flow and SET futures return.

		NIF (t=0)	
	Foreigners	**Institutions**	**Individuals**
NIF: Foreigners			
t=-1	0.080581	0.031384	-0.018035
	(0.82058)	(1.153809)	(-0.811936)
t=-2			
NIF: Institutions			
t=-1	-0.221568	0.30756***	-0.075261
	(-0.776832)	(3.893054)	(-1.166559)
t=-2			
NIF: Individuals			
t=-1	-0.54857	0.455551***	-0.020398
	(-1.127426)	(3.380137)	(-0.185333)
t=-2			
SET Futures Return			
t=-1	2.575817***	-0.33359	-0.248419
	(2.528819)	(-1.1824)	(-1.078215)
t=-2			

Table 5-9 and 5-10 report the bivariate VAR (2) model estimates by investor group for the variables; daily NIF and daily SET return/SET futures return under following equations with p lags:

$$I_{i,t} = \alpha + \sum_{\tau=1}^{p} \beta_i R_{t-\tau} + \sum_{\tau=1}^{p} \lambda_i I_{i,t-\tau} + \sum_{\tau=1}^{p} \gamma_i I_{j,t-\tau} + \varepsilon_{i,t}$$

where R_t is the SET index return for day t, $I_{i,t}$ is a vector of investment flow of investor type i for day t, $I_{j,t}$ is a vector of investment flow of another investor type j for day t, and $i \neq j$, and i and j represent type of investor; foreign, institutional, or individual investors.

* Denotes significance at the 10% level.

** Denotes significance at the 5% level.

*** Denotes significance at the 1% level.

Table 5-9 and 5-10 report the coefficient estimation of the bivariate VAR(2) model in order to investigate trading patterns into two aspects;

- The herding behavior which can be observed from the correlation coefficients between current NIF (t=0) and past NIF (t =-1 and -2) by the investor type as follows:

  - Correlation coefficients between current NIF (t=0) of investor type i and past NIF (t =-1 and -2) of investor type i (λ_i)

  - Correlation coefficients between current NIF (t=0) of investor type i and past NIF (t =-1 and -2) of another investor type j (γ_i)

According to the results, all investor groups exhibit positive autocorrelation with their trading for at least one day except individual investors who trade in futures market exhibit negative correlation with their one-day trading. That is, the coefficient on the previous day's NIF is significantly positive in each regression except individual investors in futures market.

Foreign investors in both spot and futures market show significantly positive autocorrelation with their past NIF. With other types, the results suggest that foreign

investors' herding is positively correlated with institutional traders in spot market, while negatively correlated with institutional investors in futures market. And, foreign investors' herding is negatively correlated with individual investors in both spot and futures market. Institutional investors' trade flow is positively correlated with individual investor in futures market whereas it is negatively correlated with individual investors in spot market. Individuals have a negative trade flow correlation with both foreign and institutional traders in both spot and futures market.

- The feedback trading behavior (positive or negative feedback trading), which can be examined from the correlation coefficients between NIF and past SET returns (β_i) by the investor type. If correlation coefficient (β_i) is significantly positive (negative), it means the momentum (contrarian) trading pattern.

For foreign investors, the coefficients for the first lagged return (day t=-1) in both spot and futures market are significantly positive at the 1% level, but the coefficients for day t =-2 in spot market is negative. This indicates that foreign investors are positive feedback traders on a short-term or daily period but may be negative feedback traders over a longer period. Institution investors appear to be negative feedback traders in the short-term in both spot and futures market, and for day t =-2 in spot market, it is significant at the 10% level. For individual traders, they have significantly negative coefficients at the 5% level at day t =-1 in spot market and also indicate negative feedback traders in futures market, whereas the coefficients for two-days lagged returns in spot market are significantly positive at 5% level.

In summary, during the sample period June 2011 to March 2013, the results are consistent with the research hypothesis. After taking into account investment flow autocorrelation using the bivariate VAR(2) model, foreign investors in both spot and futures market exhibit positive feedback trading pattern over the short term. In contrast, institution investors and individual investors in these two markets appear to exibit short-term negative feedback market timing characteristics.

5.4 Summary and Conclusion

In this research, I use detailed records of trading activity, trading volume, and trading value by employing a unique data set of daily aggregated purchases and sales over a 2-year period on Thailand's spot market and Thailand's futures market. The data examines the trading patterns of each investor type, which are foreign investors, institutional investors, and individual investors. The purpose is to understand the behavior of each type of investors in this interesting emerging market.

I find that the buying and selling investment flows of these three investor groups, during the sample period, from June 2011 to March 2013, are ranked as follows; the majority trader in the Stock Exchange of Thailand (SET) is the individual investor, followed by the foreign investor, and the institutional investor. The corresponding ranking in the Thailand's Derivative Market is the individual investor, then the institutional investor, and the foreign investor is the minority trader.

Moreover, the results provide empirical evidence that in Thailand's spot stock market, foreign investors were net buyers with an average net investment flow (NIF)

of 0.011271, institutional investors were net sellers with an average NIF of -0.005598, and individual investors, the largest trading group on the SET index during the sample period, were a net seller of equities with an average NIF of -0.001656. In the futures market, foreign investors were also net buyers during the sample period as in spot market with an average NIF of 0.008149 institutional investors and individual investors were net seller with an average NIF of -0.003495 and -0.000332 respectively.

To examine the feedback trading pattern, I looked at the correlation between each investor's trade flow (NIF) and the SET return/the SET futures return. The results show that in both spot market and futures market of Thailand, foreign investors trade flow is significantly positively correlated with the SET return/SET futures return during the day of the trading (t = 0). The estimates for correlation on returns during the previous (t = -1, and -2) and next day (t = 1, and 2) are also significantly positive. This suggests that foreign investors are positive feedback or momentum traders, which ties well with many prior studies, for example, Brennan and Cao (1997), who find U.S. equity investment in developed markets is positively related to foreign market return. Froot et al. (2001) find that foreign investors tend to employ momentum trading and especially in emerging markets. Lin and Swanson (2003) find that foreign investors in Taiwan employ momentum strategies of buying past winners and selling past losers during the sample period from 1996 to 2003. Richards (2005) employed the regression and Vector Auto Regression (VAR) analysis also found strong evidence that foreign investors engage in momentum trading in six Asian emerging equity markets, which are the Jakarta Stock Exchange (JSX), Korea Stock Exchange (KSE), Philippine Stock Exchange (PSE), Stock Exchange of

Thailand (SET), Taiwan Stock Exchange (TWSE), and Korean Securities Dealers Automated Quotations (Kosdaq) Stock Market.

For individual investor net investment flow in both spot and futures market is significantly negatively correlated with the market return on current, past, and future trading day. That is, individual investors tend to be contrarian investors, or negative feedback traders. The results are consistent with a number of studies, for instance, Odean (1998, 1999) studies behavior of individual investors in the U.S. and finds that individual investors tend to hold on to their losers and sell their winners and Barber and Odean (2000) also indicate that on average individual investors are contrarian investors, they tend to buy stocks that have recently underperformed the market and sell stocks that have performed well in recent weeks. Grinblatt and Keloharju (2000) find contrarian tendencies of individual investors in Finland, which is similar to Bae et al. (2002) report that trading of Japanese individual investors follow contrarian-trading patterns. Richards (2005) finds individual investors in six Asian emerging markets are contrarian investors along with Kaniel et al. (2008) illustrate individual investors in U.S. trade as they are contrarian traders. In addition, Kaniel et al. (2012) study the behavior of individual investors who trade around earnings announcements using a data set of NYSE stocks and find that individual investors are contrarians.

While, institutional investors' trading pattern in both spot and futures market is rather mixed results in different day. For example, in spot market, in day t=0, they exhibit positive feedback trading patterns or momentum traders but correlations on returns during the previous day (t=-2) shows that they employ a negative feedback or

contrarian trading strategy. The results are consistent with several empirical researches such as Grinblatt et al. (1995) find that mutual fund managers are momentum traders, whereas Odean (1998) finds that the institutions in U.S. present evidence that is consistent with contrarian trading strategies. Kamesaka et al. (2003) employ the net investment flow and Vector Auto Regression (VAR) method; they find that institutional investors in Japan follow contrarian trading. Shyu and Sun (2010) investigate the herding behavior of institutional investors in Taiwan's stock market and presented that institutional herding exists in Taiwan's stock market. De Haan and Kakes (2011) indicate that three types of institutions, which are pension funds, life insurers, and non-life insurers in Netherlands and the results present that all three investor types tend to be contrarian trader.

Additionally, the results show that in both spot and futures market, foreign investors have a significantly positive autocorrelation with their past NIF and when comparing foreign investor with other types of investor, the results suggest that foreign investors' herding is positively correlated with institutional traders in spot market, while negatively correlated with institutional investors in futures market. Foreign investors' herding is negatively correlated with individual investors in both spot and futures market. Institutional investors' trade flow is positively correlated with individual investor in futures market whereas it is negatively correlated with individual investors in spot market. Individuals have a negative trade flow correlation with both foreign and institutional traders in both spot and futures market.

Chapter 6. Empirical Analysis and Results

Investors' performance and trading sources between spot and futures market in an emerging market: New empirical evidence from Thailand"

6.1 Introduction

Under the efficient market theory, no investor types perform persistently better or worse than other investor types. However, one important debate among stock market investors and researchers is whether the market is efficient, with a variety of reasons, the academic researchers tend to view the foreign, institutional, and individual investors differently. It is not clear whether the different trading behaviors of various investor types result in significant differences in trade performances.

This chapter examines the performance of each type of investors and the sources of their trading performances. This chapter is organized as follows. In section 6.2, the background of this study is outlined. In section 6.3 the findings and results are presented and explored in details. The summary and conclusion are provided in section 6.4.

6.2 Background

When analyzing developed stock market, numerous studies have concluded that foreign and institutional investors tend to be better informed and financially sophisticated. Individual investors, on the other hand, can be subject to psychological biases, which limit their trading performance. Research, exemplified by Barber and Odean (2000), Grinblatt and Keloharju (2001), Rashes (2001), Campbell (2006), Kaniel et al. (2012), and Barber et al. (2014) shows that individual investors grossly under-diversify, trade excessively, expose themselves to a high level of risk, and make poor ex post investing decision. Investors are also prone to the disposition effect, and buy index funds with exorbitant expense ratios. Behavioral biases like these may partly explain why so many individual investors lose when trading in the stock market.

Investment trading theories and models designate the more sophisticated investor as the one who is less likely to succumb to cognitive biases or irrational behavior as stated in Banerjee (1992), Hirshleifer, et al. (1994), Glaser and Weber (2007). For example, the literature normally considers individual investors, as opposed to institutional or foreign investors, to be less sophisticated and therefore attribute irrational behavior and market anomalies to their trading. There is some compelling empirical support that sophisticated investors are more rational. Using data from Finland, Grinblatt and Keloharju (2000, 2001) find that sophisticated investors (which they believe to be the foreign investors in their case) were more likely to follow momentum trading strategies and less likely to be inclined toward a home bias. Sophistication also seems to mitigate the disposition effect. Shapira and

Venezia (2001) examine brokerage accounts in Israel and find that, on average, individuals hold on to poorly performing stocks eight days longer than do professional institutional investors.

While researchers are beginning to acknowledge that investors have propensities toward behavioral biases, we still do not know to what extent these attributes can be mitigated by experience and investor sophistication. This corresponds to two categories of theoretical models about investor trading decisions, which are rational (information-based trading) and irrational (behavioral-based trading) investors. Therefore, in this paper, I would like to examine whether the significant differences in their trade performances result from different trading decision assumptions. Under two main trading decision assumptions; the first assumption is whether the rational (information-based trading) investors; foreign and institutional investors have superior information for future stock returns. The second assumption is whether the irrational (behavioral-based trading) investors; individuals have inferior returns.

A somewhat similar picture has also been painted for emerging markets where some studies have found that foreign investors follow information-based, momentum trading strategies, with foreign investment inflows foreshadowing good subsequent returns (Froot et al., 2001). The superior trading performance of foreign investors in emerging markets, presumably at the expense of (less sophisticated) individual investors who take the other sides of foreigners' trades, raises a number of questions as to the sources of the trading performance. Is the superior performance of foreign investors in emerging markets due to good market timing, price spread, or both? How do individual investors in emerging markets perform in terms of market timing,

security selection, and (consequently) overall trading performance? How do other (presumably information-based) institutional investors behave in emerging markets, and what is their market timing and security selection performance? This paper therefore examines in detail the trading behavior as well as the market timing and security selection performance of investor types in a dynamic emerging market, the Thai stock market and the Thai futures market.

Several papers find evidence of foreign investors generate superior trade performance such as Grinblatt and Keloharju (2000) conduct an important investigation regarding trading behavior of different investors types. Using a unique data set from Finland that has a comprehensive coverage of all types of investors in the market, the study analyses how past returns determine the propensity to buy and sell for different investor classes and investors of different sophistication. The authors find that foreign investors tend to be momentum investors, buying past winning stocks and selling past losers. Domestic investors, especially individual investors, tend to behave in the opposite manner, buying past losing stocks and selling past winning stocks. They find that the portfolios of foreign investors seem to outperform the portfolios of individual investors even after controlling for behavior differences.

In contrast, Brennan and Cao (1997) present the foreign investors in U.S. achieve inferior performance because they are less informed than domestic investors. While, Odean (1998) examines trading records for 10,000 accounts in U.S. for the period 1987 through 1993 and finds that individuals get negative trading performance. In brief, Odean compares the rate at which investors sell winners (realized gains) and

losers (realized losses) and compares the realization of gains and losses to the opportunities to sell winners and losers.

Barber and Odean (2001) indicate that individual investors in the United States get poor net returns when comparing against the various benchmarks such as the multifactor benchmark and the market portfolio. Specifically, the highest trading investors earn an annual return of 11.4 percent, compared to the market returns 17.9 percent. Their findings that individual investors who trade more obtain lower net returns carry important messages to regulators and brokerage firms regarding the merits of encouraging individual trading. Nevertheless, the key message of the study is that individual investors are over-confident about their own investment skills and consequently, trade upon noise, as opposed to true information, which results in unprofitable trades and wasted transaction costs. While, Kaniel et al. (2012) illustrate that stocks that individuals bought intensely in the two weeks before the announcements outperform those that they sold intensely, on average, by 3.80% in the three months following the event, they found that individual investor in U.S. gained from their trading. Furthermore, the performance of this strategy during the event window is 0.29% compared with 1.47% for earnings announcements. On the other hand, Barber et al. (2014) find individual investors lose money from their trade during the sample period from 1992 to 2006, which there were about 450,000 Taiwanese individual traders engaged in day trading.

In addition, Barber et al. (2004) find institutional investors gain positive excess returns whereas individual investors have poor market return in the Taiwanese stock market and Choe et al. (2005) find no evidence of better-informed foreign investors

in Korea. Dvořák (2005) finds domestic investors in Indonesia have an information advantage over foreign investors on average, resulting in domestic investors have higher profits than foreign investors. Besides, Barber, Dean, and Zhu (2009) indicate that individual investor trading activities in Taiwan are not well founded and do not achieve particularly impressive returns. They show that the aggregate portfolio of individuals suffers an annual performance penalty of 3.8 percentage points. Individual investor losses are equivalent to 2.2 percent of Taiwan's gross domestic product or 2.8 percent of the total personal income. Interestingly, they find that the trades hurting individual investors the most are those about which individual investors are most aggressive. In contrast, institutions enjoy an annual performance boost of 1.5 percentage points and both the aggressive and passive trades of institutions are profitable. This study not only puts a number to the considerable losses that individual investors face at the national level, but also provides a few specific directions such as behavioral biases as to why individuals obtain such disappointing performance.

No paper so cleanly addresses the issue of whether different investor types generate differences in trading behavior and investment performance. Research finds investors are not always rational; instead some investors are inclined toward various types of behavioral biases, which lead them to make cognitive errors. Hirshleifer (2001) indicates that there are different types of cognitive errors that investors can make such as self-deception, it is one type of cognitive error that occurs because people tend to think that they are better than they really are. Both the psychology and the recent finance literature characterize people with this type of behavior as being "overconfident." Investors who are overconfident believe they can obtain large

returns, thus they trade often and they underestimate the associated risks. Several empirical evidences find support for this theory. Barber and Odean (2000, 2001) and Odean (1999) study the trading patterns of 78,000 U.S. households over the 1991-1997 period and find that investors trade too much and that they hold high-risk portfolios. In fact, as a result of overconfident tendencies, Odean (1999) finds that individual investors make poor trading decisions, ex post. That is, stocks that individuals sell subsequently outperform stocks that they buy.

Additionally, another type of cognitive error, heuristic simplification, occurs because individuals have limited attention, memory, and processing capabilities. One form of heuristic simplification is mental accounting, where the mind keeps track of gains and losses related to decisions (Thaler, 1980). According to Hirshleifer (2001), mental accounting may explain the "disposition effect." Simply stated, people want their good decisions to be recognized immediately in their mental accounts, but they postpone acknowledging their bad decisions. This behavioral bias has implications for investing behavior. That is, investors may sell stocks that have performed well so that they can feel good about themselves, or so they can boast to others about their ability to pick good stocks. At the same time, investors may hold on to their poorly performing stocks because they are not ready to acknowledge that they made a mistake, and because they are afraid that the stocks may recover (Shefrin and Statman, 1985). Odean (1998) finds empirical support this, specifically, he finds that individual investors are more willing to recognize paper gains than paper losses.

Psychologists have found, however, that people with varying degrees of experience in an activity succumb to cognitive biases at different levels. One might think, for

instance, that accumulated experience reduces the tendency to commit cognitive errors. However, some researchers believe that certain behavioral biases, like overconfidence, may actually be exacerbated with experience. Take, for example, the stock market environment where the level of predictability is very low. Here, experts may even be more prone to overconfidence than novices because they have theories and models with which they may tend to overweigh (Griffin et al., 2003). Gervais and Odean (2001) present a model in which investors learn to be overconfident because they experience a bull market. Thus, those investors who have been investing through a bull market are predicted to exhibit more overconfident characteristics than new investors. In this way, more sophisticated investors (those with experience) may suffer from cognitive biases at a stronger level than less sophisticated investors.

In this paper investigates this issue using data that include trades of all investor types that trade on the Stock Exchange of Thailand and Thailand's Derivative Market. This paper not only compares the trading performance of all investor types across the entire equity market but also measures trading gains and losses from different sources. I examine the impact of price spreads and market timing on the trading performance of various investor types. This is more powerful performance measurement, which not only compares the trading performance of all investor types across the entire equity market, but also measures trading gains and losses from different sources.

Moreover, in this study focuses on both stock and futures trading because of their relative importance in the financial marketplace. Stocks and futures markets are two

of the most actively traded instruments worldwide. Moreover, the stock and futures markets are good places to look for behavioral anomalies. Referring to Warneryd (2001) describes the stock market as highly emotional. The psychological concept of investor emotions, overreactions or underreactions to information, feelings of optimism, and self-confidence are highly prevalent in the stock market, and these factors play an important part in driving investor behavior. Another motivation for the study is that stock markets are thought to be the most efficient of all markets. The futures market is also a good place to look for anomalies. Futures traders need to keep their senses sharp through hours of tumult, noise, and general confusion. They need to have skill, knowledge, persistence, motivation, and, especially, control of their emotions in order to remain psychologically rational amid the chaos that results from split-second trading.

The objectives of this study is to investigate and compare trade performance of each investor type in the Stock Exchange of Thailand (SET) and the Thailand's Derivatives Market by decomposing trade performance into two sources; trading price spreads, and market timing.

6.3 Findings and Results

6.3.1 Descriptive Statistics

Figure 6-1 (6-2) presents the daily trading value (volume) and the proportion of that value (volume) in the total trading value (volume) between year 2011 and year 2014 on the spot market in Thailand. These buying and selling investment flows are

classified by three investor groups, which are institutional, foreign, and individual investors.

According to these figures, the majority trader is individual investors, which account for more than 50% of total trading value and more than 80% of total trading volume. Other investor groups, foreign and institutional investors account for relatively small shares of the trades, which less than 10% of total trading volume and around 20% of total trading value.

Figure 6-1: The daily trading value and the proportion of that value in the total trading value between year 2011 and year 2014 on the spot market in Thailand for three investor groups.

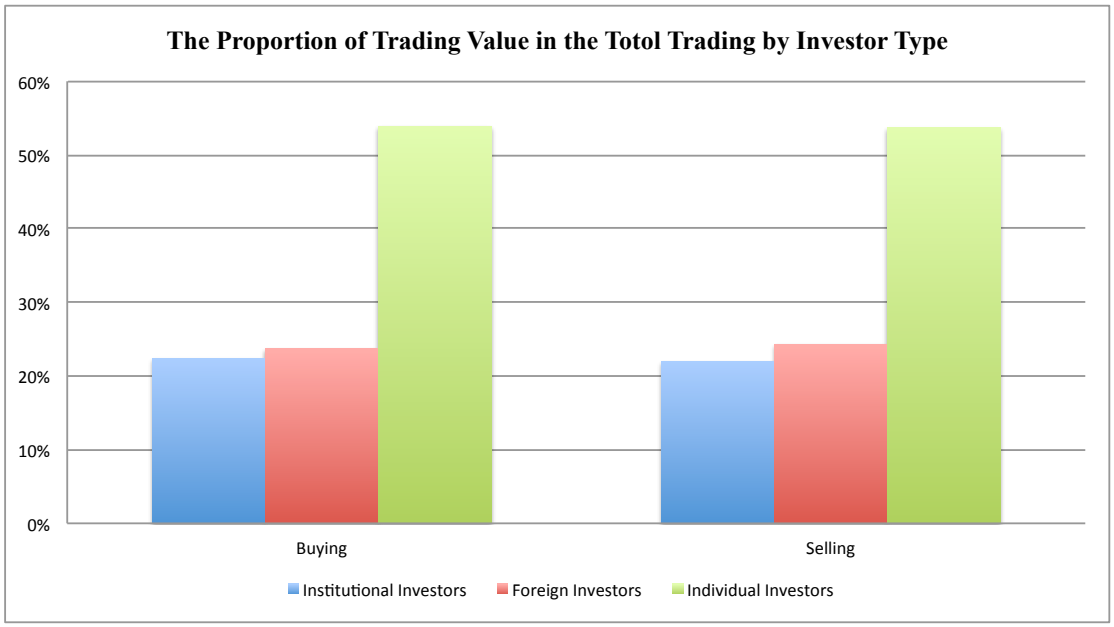


Figure 6-2: The daily trading volume and the proportion of that volume in the total trading volume between year 2011 and year 2014 on the spot market in Thailand for three investor groups.

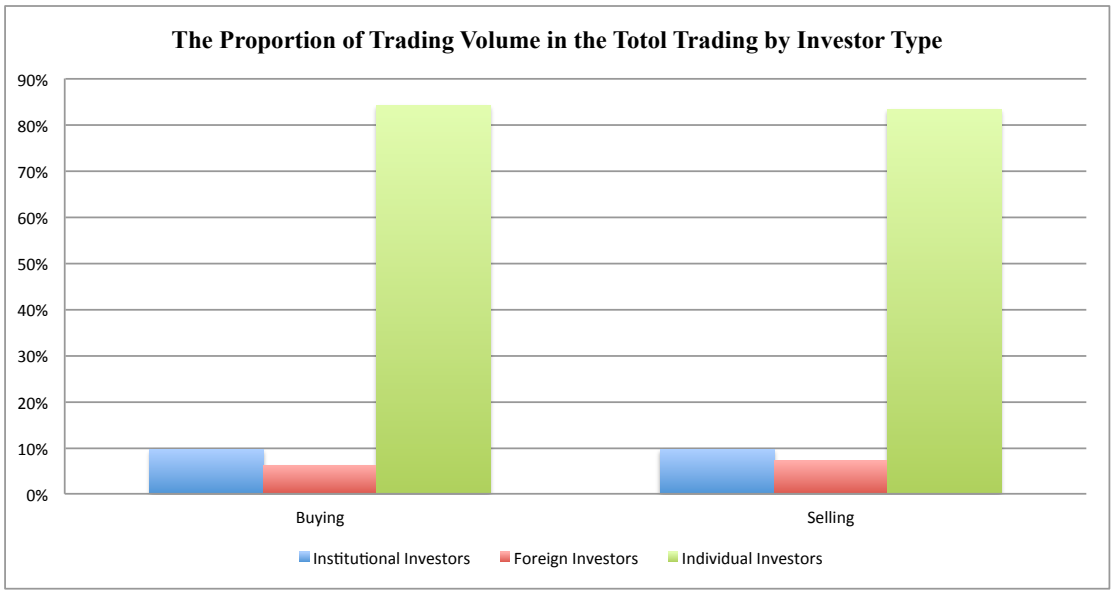


Figure 6-3 and 6-4 show the daily trading value and volume and the proportion of that value and volume in the total trading value and volume on the futures market in Thailand, respectively. From these figures, individual investor is also the majority trader in the Thailand's futures market, which account for more than a half of total trading value and volume followed by institutional and individual traders, respectively.

Figure 6-3: The daily trading value and the proportion of that value in the total trading value between year 2011 and year 2014 on the futures market in Thailand for three investor groups.

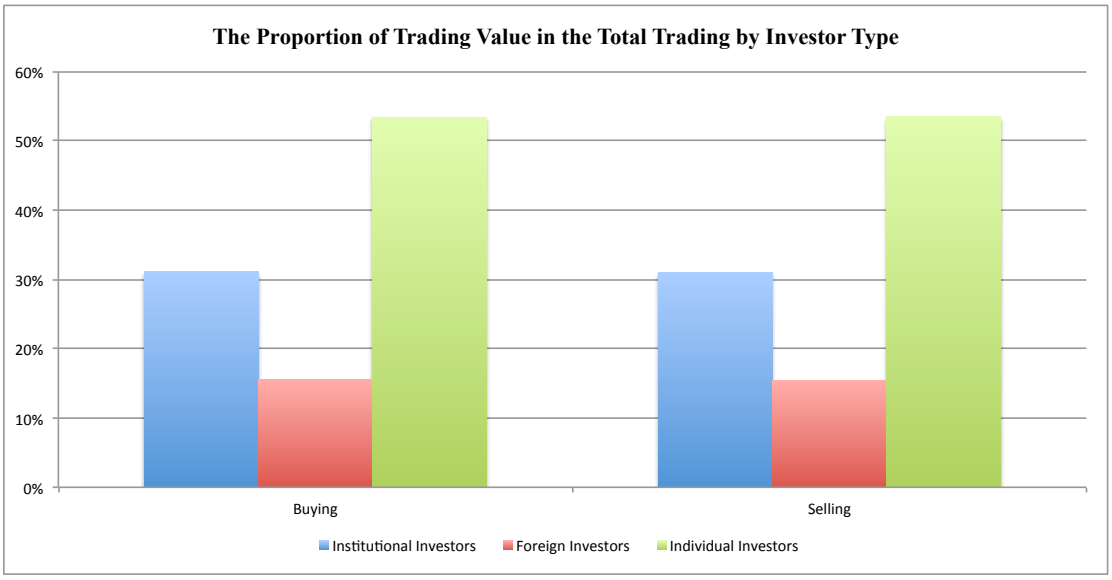
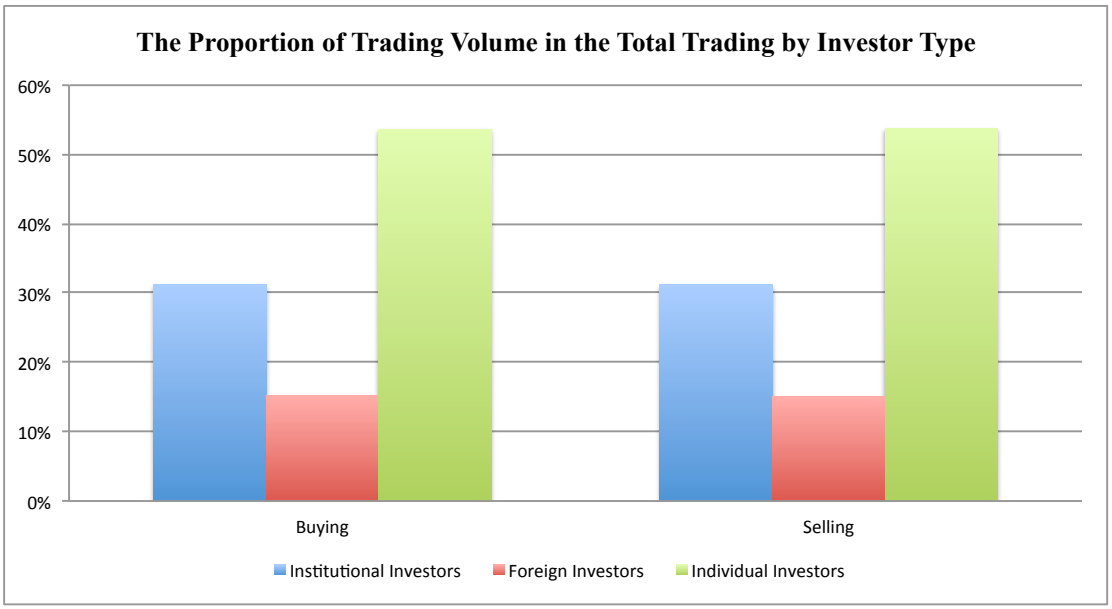


Figure 6-4: The daily trading volume and the proportion of that volume in the total trading volume between year 2011 and year 2014 on the futures market in Thailand for three investor groups.



6.3.2 Investment Performance of Investor Groups

Table 6-1 summarizes the net value and net volume of the dataset. Additionally, these net investment flows are classified into three investor groups, including foreign investors, institutional investors, and individual investors. The results of the analysis are reported in Panel A and B. Panel A presents the data from the spot market, institutional investors have an averaged daily net value of 131 million baht during the sample period. Overall, the net value of foreign investors is -205 million baht whereas individual investors experience the positive net value that is 73.9 million baht.

Table 6-1: Summarizes the net value and the net volume of the spot and futures market.

Panel A: Summary statistics of daily net value and net volume of the Stock Exchange of Thailand.

(Million Unit)	Minimum	Maximum	Mean (daily)	Standard Deviation
Institutional Investors				
Net Value	-7.18E+03	6.83E+03	1.31E+02	1.67E+03
Net Volume	-6.58E+02	6.97E+02	-9.95E-01	1.52E+02
Foreign Investors				
Net Value	-1.69E+04	1.45E+04	-2.05E+02	2.37E+03
Net Volume	-3.62E+03	9.68E+02	-6.65E+01	2.57E+02
Individual Investors				
Net Value	-1.68E+04	1.33E+04	7.39E+01	2.66E+03
Net Volume	-1.06E+03	3.61E+03	6.75E+01	2.95E+02

Panel B: Summary statistics of daily net value and net volume of the Thailand's Derivative Market.

(Unit)	Minimum	Maximum	Mean (daily)	Standard Deviation
Institutional Investors				
Net Value	-3585126	3561621	4072.815	828960.3
Net Volume	-3566	2896	4.366423	916.0616
Foreign Investors				
Net Value	-3944236	6071302	7652.461	968012.8
Net Volume	-4387	6859	20.09781	1133.513
Individual Investors				
Net Value	-4643057	5208855	-13522.37	1095974
Net Volume	-5004	4850	-24.46277	1253.19

Table 6-1 reports the descriptive statistic of daily net trading value and daily net trading volume of the Stock Exchange of Thailand and Thailand's Derivative Market by classifying into three investor types, which are institutions, foreigners, and individuals.

Panel B presents the summary descriptive statistic using the data from the futures market, I find that institutional investors and foreign investors have daily net volume on average about 4.36 contracts and 20.09 contracts respectively. While individual investors have an averaged net volume of -24.46 contracts.

6.3.3 Trading Performance of Different Types of Investors

I start the analysis with a depiction of the return performance of the various investor groups in the sample for two reasons. First, I wish to show that there are indeed

significant performance differences among the main investor-types as suggested by the previous literature, however in this paper I differentiate from previous papers by focusing on both spot and futures market in an emerging country. Second, by analyzing the source of trading performance (market timing and price spread) matters in economic terms.

To study the economic consequences of trading in Thailand's spot and futures market, I first compute the profits and realized returns of each trades. Then I aggregate to the level of each investor or each type of investors. The realized returns are based on the actual transaction prices, which account for the buy-sell amount. In this section, I examine trading gains and losses of various investor types. I define the net trading gains as net cash inflows generated by trades. I assume that investor initially buys (sells) the portfolios of shares during week t and subsequently sells (buys) the same number of shares during week t+h. Given the same number of shares traded, trade performance is determined by the spread between buy and sell prices. Moreover, the trade performance is also determined by the allocation (or the timing) of trades over a specified period. The investors could achieve better market timing performance if they allocated more buy trades than sell trades before increases in market returns.

To evaluate which investor groups traded with the good timing in Thailand's equity and derivative market, I first estimate the aggregate following one day return based on each investor's net investment flow (Grinblatt and Titman (1993) and Kamesaka, Nofsinger and Kawakita (2003)). Following the work of Kamesaka et al. (2003), this study utilizes daily purchase and sale flows to characterize the market timing ability

of investor groups. Purchases and sales proxy for ownership or portfolio holdings in examination of market returns after each trading day. I estimate the cumulative return due to the daily changes in investment flow and the following market return for each investor group.

Figure 6-5: Cumulative performance. The comparison of the performance of market timing of each type of investors in the spot market.

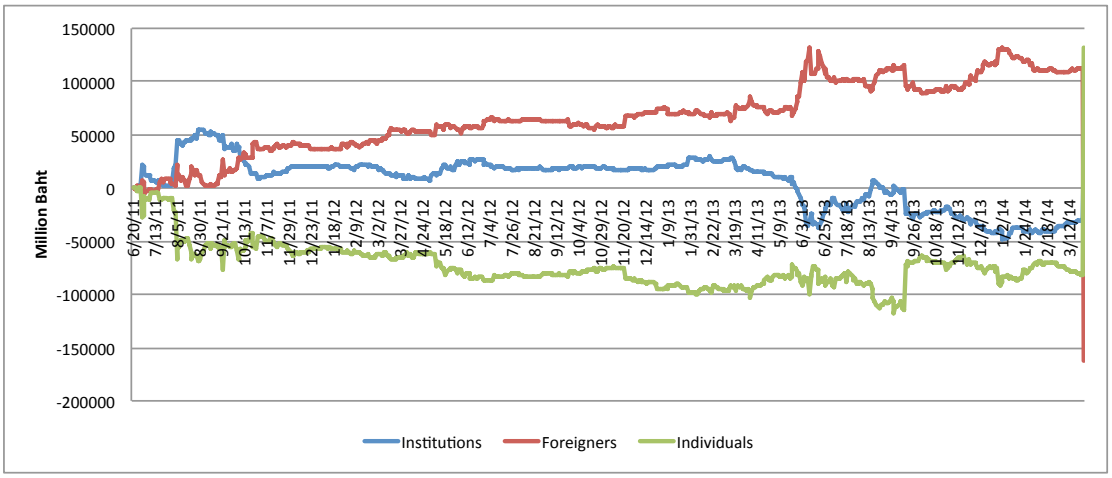
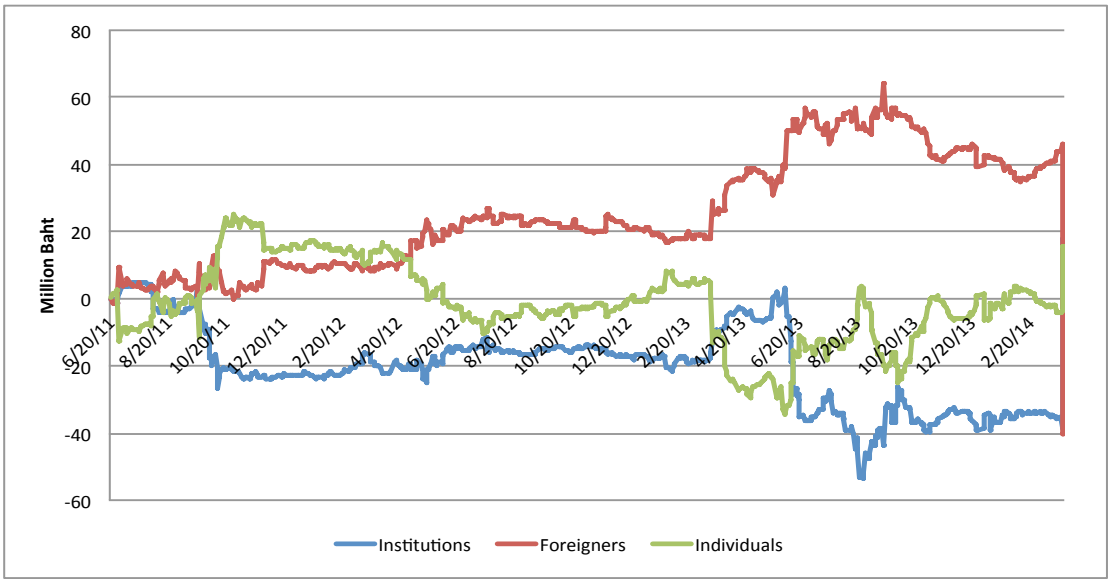


Figure 6-6: Cumulative performance. The comparison of the performance of market timing of each type of investors in the futures market.



I present the findings on daily cumulative performance by way of graphs. The numbers on the horizontal axis of these figures represent time as denoted by month, day, and year (MMDDYY). The y-axis shows the cumulate return in million baht. Figure 6-5 reports the comparative performance of different investor-types regardless of how they trade in the Thailand's spot market. The worst returns are recorded for individual investors. Returns earned by local institutional investors are generally inferior to those of foreigners since last quarter of year 2011 till the end of the sample period. These results are consistent with many findings for example Odean (1999) who examines return patterns before and after the transactions of the accounts of a discount brokerage house and finds that individual investors lower their returns through trading. Moreover, Nofsinger and Sias (1999) state that individual traders may be among the first to suffer losses. The bad performance of individual investors in Thailand may also be due to the mistiming of short-term momentum cycles.

Figure 6-6 shows the performance measure of institutional, foreign, and individual investors in Thailand's futures market. Without doubt, foreign traders traded with good market timing in all stage of the sample period. In contrast, domestic institutions investors trade with bad timing. Individual traders neither earn profits nor suffer losses during these periods. In line with the findings of Grinblatt and Keloharju (2000) and Seasholes (2000), foreigners perform better than the two local investor-types.

Moreover, in this paper I estimate the trading performance for each investor type, under slightly different conditions. I assume that there are only two main trading sources. One is the market timing and the other is price spread. Figure 6-7 and 6-8

present the comparison of the performance of price spread of each type of investors in the spot and the futures market respectively.

Figure 6-7: Cumulative performance. The comparison of the performance of price spread of each type of investors in the spot market.

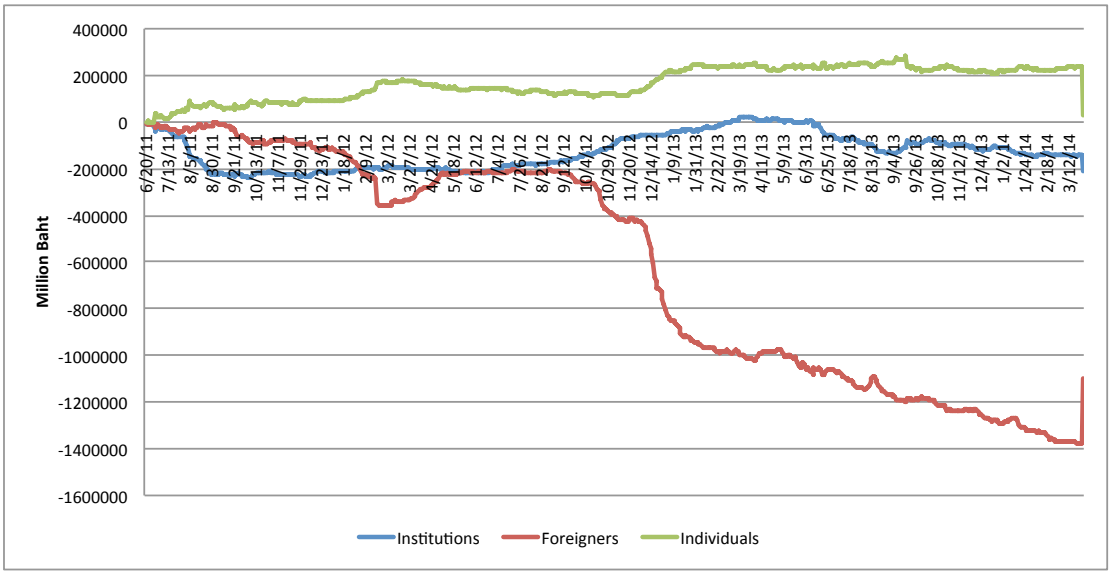
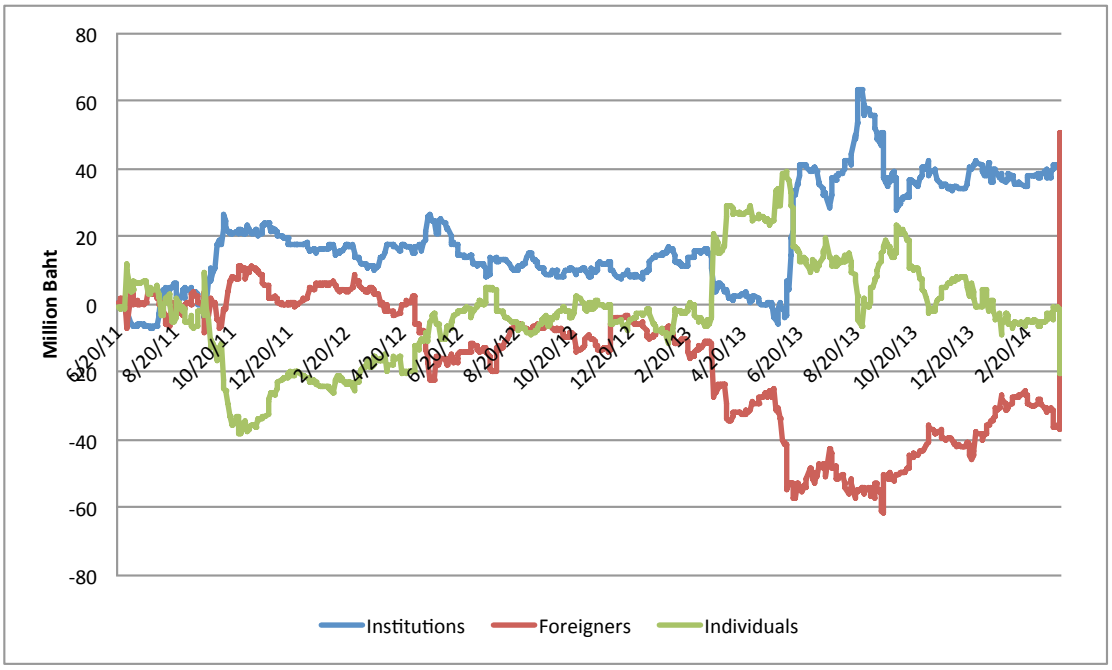


Figure 6-8: Cumulative performance. The comparison of the performance of price spread of each type of investors in the futures market.



For the performance from price spread, figure 6-7 presents the comparison of the performance of price spread of each type of investors in the spot market. It shows that foreign investors generally make losses on their trades, while domestic individual traders make as much in gains. Figure 6-8 indicates that there was a subsequent fall in the performance from price spread of foreigners during the sample period whereas domestic institutions gain from their trading.

I separate market timing from price spread trade performance and measure returns for these two groups as depicted in the above figures The results show a clear divergence between the performance of market timing and price spread. Tracing the performance of the three main investor-types separately based on their source of trading performance, I present the results of the findings on market timing, price spread, and overall net trading respectively.

Figure 6-9: Cumulative performance. The comparison of the overall net trading performance of local institutions, foreign investors, and individual traders in the spot market.

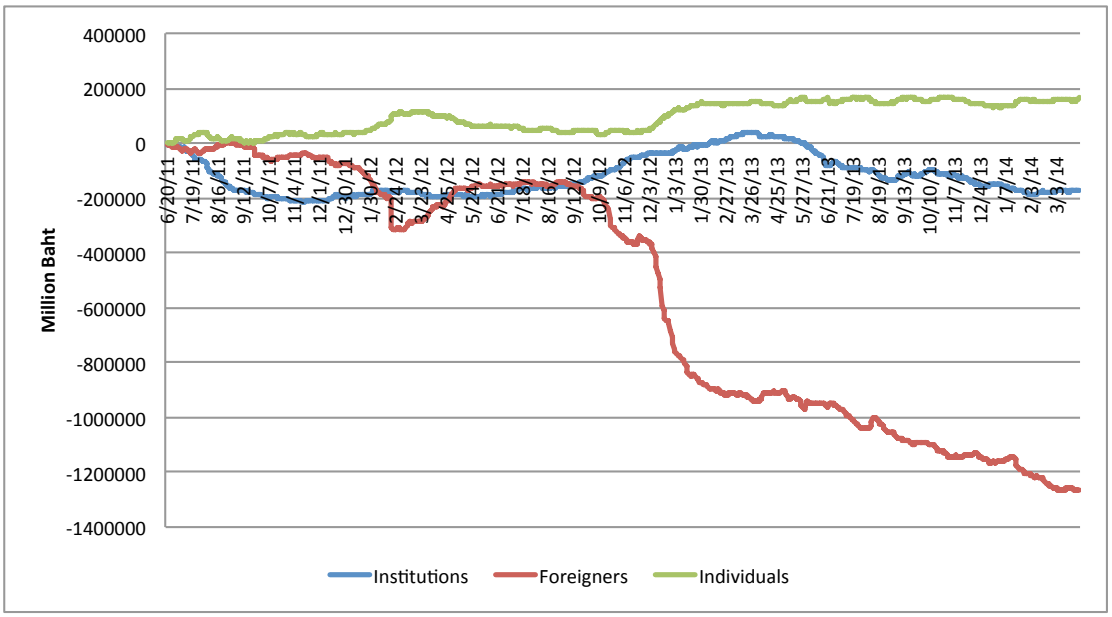
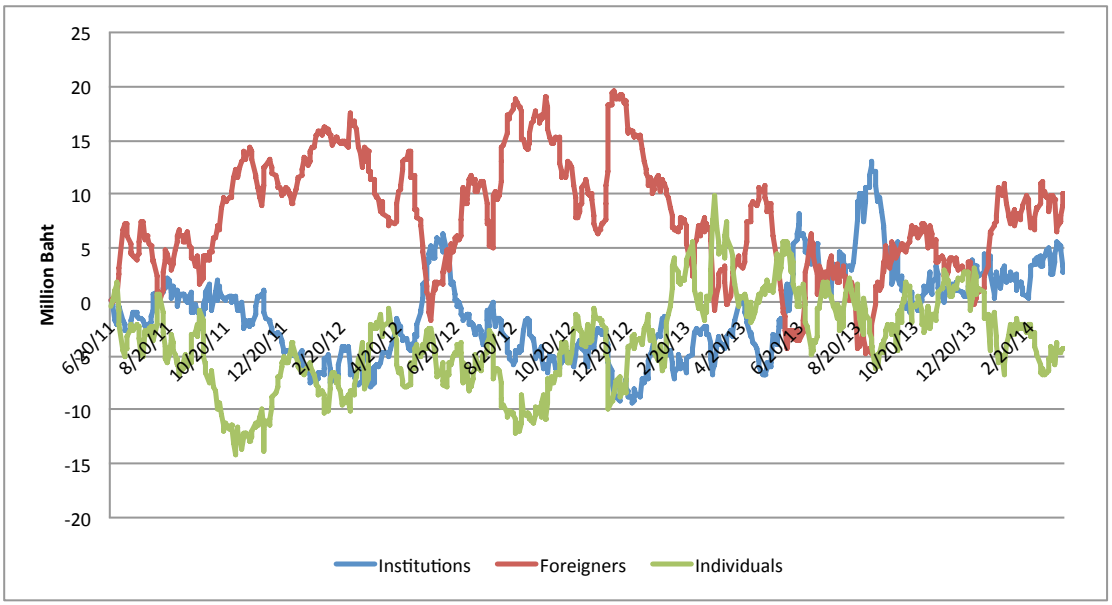


Figure 6-10: Cumulative performance. The comparison of the overall net trading performance of local institutions, foreign investors, and individual traders in the futures market.



The hierarchy of performance (Institutions-Foreigners-Individuals) is largely maintained across the two methods of the source of trading performance. A comparison that shows in Figure 6-9 indicates the comparison of the overall net trading performance of local institutions, foreign investors, and individual traders in both Thailand's spot and futures market, these figures exhibit that for all investor-types, there is a significant different in their trading performance during the sample period. In the futures market, figure 6-10 indicates that the overall net trading performance of foreign investors are generally superior to other groups. While foreign traders make significant losses in the spot market, both institutions and foreign traders earn higher returns.

In conclusion, individual investors trade with bad market timing in the spot market but the performance from price spread, individual investors perform well in the spot

market. Overall, individual investors perform well in the spot market. While they neither earn profits nor suffer losses during the sample period in both the spot and the futures market. For foreign traders, they traded with good market timing during the entire period in both the spot and futures market. However, when looking at the price spread performance, they perform worse than other investor-types in both markets. These figures also exhibit that foreign investors loss from their overall net trading in the spot market but gain from their overall net trading in the futures market. Domestic institutions trade with bad timing but good performance at price spread in the futures market. Generally, institutional investors have a good overall net trading performance in both the spot and the futures market.

According to the trade performance measure above, in this section I also undertake the Wilcoxon signed-rank test to test assess statistically whether there is any discernible difference between the performance of the relevant groups. I conduct a test against the null hypothesis of zero median using the non parametric signed-rank test. Note that sum of the net gains do not equal overall gains because each component represents the median for sample. The tables presented below show the value of the test statistics together with the 2-tailed exact p-values.

The trading performance of each investor type in the Thai stock market and the Thai futures market are examined in Table 6-2 and Table 6-3 where the median value of the overall trade performance measure (π_t) as well as the market timing (π_t^T) and security selection or spread (π_t^S) components of trading gains of each investor type are reported for trading intervals of length (h) = one day, one week, one month, and one quarter.

Table 6-2: Wilcoxon signed rank test. Performance comparison in the spot market.

	Institutions		Foreigners		Individuals	
One Day	Test Statistic	p-value	Test Statistic	p-value	Test Statistic	p-value
Overall Trading	-2.429	0.015	-5.860	0.000	-1.089	0.276
Market Timing	-1.786	0.074	-0.194	0.846	-0.105	0.916
Price Spread	-0.610	0.542	-6.452	0.000	-1.612	0.107
One Week	Test Statistic	p-value	Test Statistic	p-value	Test Statistic	p-value
Overall Trading	-2.625	0.009	-6.122	0.000	-0.526	0.599
Market Timing	-2.305	0.020	-1.647	0.100	-0.057	0.955
Price Spread	-2.815	0.005	-3.181	0.001	-1.555	0.120
One Month	Test Statistic	p-value	Test Statistic	p-value	Test Statistic	p-value
Overall Trading	-2.652	0.008	-6.303	0.000	-0.852	0.394
Market Timing	-0.013	0.989	-0266	0.790	-0.944	0.345
Price Spread	-1.007	0.314	-1.517	0.129	-1.424	0.155
One	Test	p-value	Test	p-value	Test	p-value

Quarter	Statistic		Statistic		Statistic	
Overall Trading	-2.533	0.011	-7.168	0.000	-0.245	0.806
Market Timing	-1.334	0.182	-0.763	0.446	-0.555	0.579
Price Spread	-5.110	0.000	-0.110	0.912	-1.610	0.107

Table 6-2 presents performance comparison of different investor types in the spot market. The measure decomposes net trading gains, Π_t, into two components, which are gains arising from price spreads (π_t^s) and gains arising from market timing (π_t^T) over different trading periods.

The results indicate that there is a significant difference between groups of foreigners for overall trading and price spread, except for the market timing performance that is no significant difference during the short period. Foreign investors are very good short-term security selection (price spread) performance (-6.452). For individual investors, the results show that there are strong evidences favoring the null hypothesis for the overall trading and the market timing whereas there is a close rejection of the null hypothesis for the price spread performance during the entire sample period. When I examine the test of institutions during the short period, there is a significant difference between groups for overall trading and market timing. While considering institution investors during the long-term period, h = one quarter, there is strong evidence to reject the null hypothesis for the overall trading and the price spread.

Table 6-3: Wilcoxon signed rank test. Performance comparison in the futures market.

	Institutions		Foreigners		Individuals	
One Day	Test Statistic	p-value	Test Statistic	p-value	Test Statistic	p-value
Overall Trading	-1.940	0.052	-3.112	0.002	-1.842	0.065
Market Timing	-0.602	0.547	-1.049	0.294	-0.496	0.620
Price Spread	-0.763	0.446	-0.626	0.531	-0.125	0.900
One Week	Test Statistic	p-value	Test Statistic	p-value	Test Statistic	p-value
Overall Trading	-1.773	0.076	-2.699	0.007	-1.820	0.069
Market Timing	-1.935	0.053	-0.654	0.513	-1.590	0.112
Price Spread	-1.860	0.063	-0.087	0.930	-0.976	0.329
One Month	Test Statistic	p-value	Test Statistic	p-value	Test Statistic	p-value
Overall Trading	-1.762	0.078	-1.939	0.052	-0.736	0.462
Market Timing	-0.897	0.370	-0.719	0.472	-0.148	0.882
Price Spread	-0.852	0.394	-0.089	0.929	-0.520	0.603
One	Test	p-value	Test	p-value	Test	p-value

Quarter	Statistic		Statistic		Statistic	
Overall Trading	-0.856	0.392	-0.754	0.451	-0.846	0.397
Market Timing	-0.645	0.519	-0.635	0.526	-0.474	0.636
Price Spread	-0.542	0.588	-0.583	0.560	-1.054	0.292

Table 6-3 presents performance comparison of different investor types in the futures market. The measure decomposes net trading gains, Π_t, into two components, which are gains arising from price spreads (π_t^s) and gains arising from market timing (π_t^T) over different trading periods.

When I consider the performance of all investor groups during the short period in the Thailand's futures market, the evidence does not favor differential levels of performance and only in the case of the overall net trading gains can I reject the null hypothesis of the test. The results during the medium term, h = one month, indicate that if I examine foreign and institution investors similar evidence are obtained, their overall trading performance are significant at 10 percent level. While for the individual investors, all sources of trading performance accept the null hypothesis of the test. However, for the long term (one quarter), the results present that there is no significant for the test, the trading performance of foreigners and individuals are similar to the institutions.

Table 6-4 reports the correlations of overall net trading gains (Π), gains from the market-adjusted spreads between sell and buy price (π^S), and gains from market timing (π^T) for various investor types in the Thailand's spot market and the

Thailand's futures market. I exhibit the trading interval (h) of one day, one week, one month, and one quarter for representing short-, medium, and long-term. In Table 6-4.1, Panel A shows that overall net trading gains (Π) of institutional investors tend to increase when overall net trading gains (Π) of foreign and individual investors decrease. Also, Thailand individual investors have significantly negative trade flow correlation with foreign investors. Panel B presents the correlation of the performance from market timing of each type of investors. The results show that the performance from market timing of institutional investors is uncorrelated with foreigners while it is negatively correlated with the individual investors in the short-term period. Panel C exhibits the correlation of the performance from price spread, the results indicate that there is no correlation between institutions and foreigners in the spot market in Thailand. However, individuals have a significantly negative trade correlation with institutional and foreign investors. It is interesting that the results of trading performance during one week and one month trading interval, which show in Table 6-4.2 and Table 6-4.3, are consistent with each other. Institutions, foreigners, and individuals all have a significantly negative trade performance correlation with each other. For trading in the long-term period, Table 6-4.4 reports that the trade flow correlation of overall net trading among institutional, foreign, and individual investors are negative. While, there is positively correlated between institutions and foreigners for both the performance from market timing and price spread. Thailand individual investors trade performance is negatively correlated with both institutions and foreigners.

Table 6-4: Correlation of trading performance in the spot market.

Table 6-4.1: Correlation of trading performance between various investor types, h = one day

	Institutions	Foreigners	Individuals
Panel A: Correlation of overall trading performance			
Institutions	1	-0.093766*	-0.090938*
Foreigners	-0.093766*	1	-0.536414**
Individuals	-0.090938*	-0.536414**	1
Panel B: Correlation of market timing performance			
Institutions	1	0.066175	-0.665374**
Foreigners	0.066175	1	-0.788905**
Individuals	-0.665374**	-0.788905**	1
Panel C: Correlation of price spread performance			
Institutions	1	0.003849	-0.506544**
Foreigners	0.003849	1	-0.534631**
Individuals	-0.506544**	-0.534631**	1

Table 6-4.2: Correlation of trading performance between various investor types, h = one week

	Institutions	Foreigners	Individuals
Panel A: Correlation of overall trading performance			
Institutions	1	-0.142123**	-0.524022**
Foreigners	-0.142123**	1	-0.709856**
Individuals	-0.524022**	-0.709856**	1
Panel B: Correlation of market timing performance			
Institutions	1	-0.139299**	-0.444622**
Foreigners	-0.139299**	1	-0.82505**
Individuals	-0.444622**	-0.82505**	1
Panel C: Correlation of price spread performance			

Institutions	1	-0.080179*	-0.554712**
Foreigners	-0.080179*	1	-0.757723**
Individuals	-0.554712**	-0.757723**	1

Table 6-4.3: Correlation of trading performance between various investor types, h = one month

	Institutions	Foreigners	Individuals
Panel A: Correlation of overall trading performance			
Institutions	1	-0.156198**	-0.486682**
Foreigners	-0.156198**	1	-0.783192**
Individuals	-0.486682**	-0.783192**	1
Panel B: Correlation of market timing performance			
Institutions	1	-0.300139**	-0.371048**
Foreigners	-0.300139**	1	-0.774434**
Individuals	-0.371048**	-0.774434**	1
Panel C: Correlation of price spread performance			
Institutions	1	-0.379645**	-0.273812**
Foreigners	-0.379645**	1	-0.781071**
Individuals	-0.273812**	-0.781071**	1

Table 6-4.4: Correlation of trading performance between various investor types, h = one quarter

	Institutions	Foreigners	Individuals
Panel A: Correlation of overall trading performance			
Institutions	1	-0.154287**	-0.480148**
Foreigners	-0.154287**	1	-0.792084**
Individuals	-0.480148**	-0.792084**	1
Panel B: Correlation of market timing performance			
Institutions	1	0.848834**	-0.899857**

Foreigners	0.848834**	1	-0.994423**
Individuals	-0.899857**	-0.994423**	1
Panel C: Correlation of price spread performance			
Institutions	1	0.827117**	-0.880891**
Foreigners	0.827117**	1	-0.992527**
Individuals	-0.880891**	-0.992527**	1

Table 6-4 reports the correlations of overall net trading gains (Π_t), gains from price spreads (π_t^S), and gains from market timing (π_t^T), in the spot market for various investor types, which are institutions, foreigners, and individuals. The correlation coefficients are calculated for the trading interval (h) of one day, one week, one month, and one quarter, respectively.

*Correlation is significant at the 0.05 level (2-tailed).

**Correlation is significant at the 0.01 level (2-tailed).

I classify the data in this table into several maturity; short-term, medium-term, and long-term. Table 6-5 provides the correlations of overall net trading gains (Π), gains from market timing (π^T), and gains from the market-adjusted spreads between sell and buy price (π^S) for various investor types in the Thailand's futures market. Apparently, foreigners and individuals are negatively correlated with institutions for the performance of overall trading, market timing, and price spread during the short period. When the overall trading performance of institution investors increases by 1, the overall trading performance of foreigners and individuals will decrease by 0.261 and 0.463, respectively. Table 6-5.2 and Table 6-5.3 also report the correlation of each source of trading performance with longer time period. The overall trade performance of domestic institutions is negatively correlated with foreigners and domestic individuals. In addition, these table show that all these three types of investors have a significantly negative correlation with each other for the market

timing performance and the security selection performance. During the long-term period, the overall trading performance of institutional, foreign, and individual investors is all significantly negative correlated. For both market timing and price-spread performance, there is no correlation between domestic institutional and foreign investors whereas Thailand domestic individuals are negatively correlated with foreigners and institutions.

Table 6-5: Correlation of trading performance in the futures market.

Table 6-5.1: Correlation of trading performance between various investor types, h = one day

	Institutions	Foreigners	Individuals
Panel A: Correlation of overall trading performance			
Institutions	1	-0.261289**	-0.46351**
Foreigners	-0.261289**	1	-0.702781**
Individuals	-0.46351**	-0.702781**	1
Panel B: Correlation of market timing performance			
Institutions	1	-0.309625**	-0.483521**
Foreigners	-0.309625**	1	-0.616044**
Individuals	-0.483521**	-0.616044**	1
Panel C: Correlation of price spread performance			
Institutions	1	-0.28971**	-0.489582**
Foreigners	-0.28971**	1	-0.63443**
Individuals	-0.489582**	-0.63443**	1

Table 6-5.2: Correlation of trading performance between various investor types, h = one week

	Institutions	Foreigners	Individuals
Panel A: Correlation of overall trading performance			

Institutions	1	-0.284734**	-0.433311**
Foreigners	-0.284734**	1	-0.71704**
Individuals	-0.433311**	-0.71704**	1
Panel B: Correlation of market timing performance			
Institutions	1	-0.31308**	-0.43809**
Foreigners	-0.31308**	1	-0.657119**
Individuals	-0.43809**	-0.657119**	1
Panel C: Correlation of price spread performance			
Institutions	1	-0.305298**	-0.427578**
Foreigners	-0.305298**	1	-0.70266**
Individuals	-0.427578**	-0.70266**	1

Table 6-5.3: Correlation of trading performance between various investor types, h = one month

	Institutions	Foreigners	Individuals
Panel A: Correlation of overall trading performance			
Institutions	1	-0.28666**	-0.416577**
Foreigners	-0.28666**	1	-0.718716**
Individuals	-0.416577**	-0.718716**	1
Panel B: Correlation of market timing performance			
Institutions	1	-0.18871**	-0.470768**
Foreigners	-0.18871**	1	-0.698724**
Individuals	-0.470768**	-0.698724**	1
Panel C: Correlation of price spread performance			
Institutions	1	-0.222614**	-0.5474**
Foreigners	-0.222614**	1	-0.664911**
Individuals	-0.5474**	-0.664911**	1

Table 6-5.4: Correlation of trading performance between various investor types, h = one

quarter			
	Institutions	Foreigners	Individuals
Panel A: Correlation of overall trading performance			
Institutions	1	-0.287117**	-0.413587**
Foreigners	-0.287117**	1	-0.718872**
Individuals	-0.413587**	-0.718872**	1
Panel B: Correlation of market timing performance			
Institutions	1	0.598232**	-0.81725**
Foreigners	0.598232**	1	-0.939018**
Individuals	-0.81725**	-0.939018**	1
Panel C: Correlation of price spread performance			
Institutions	1	0.481578**	-0.762709**
Foreigners	0.481578**	1	-0.92372**
Individuals	-0.762709**	-0.92372**	1

Table 6-5 reports the correlations of overall net trading gains (Π_t), gains from price spreads (π_t^S), and gains from market timing (π_t^T), in the futures market for various investor types, which are institutions, foreigners, and individuals. The correlation coefficients are calculated for the trading interval (h) of one day, one week, one month, and one quarter, respectively.

*Correlation is significant at the 0.05 level (2-tailed).

**Correlation is significant at the 0.01 level (2-tailed).

Table 6-6 exhibits the sources of trading performance of each type of investors from short term to long term in the Thailand's spot market. Linkages between the overall trading gains of institutions and the market timing (the price spread) during the sample period of h=one day and h=one week are similar, they are significant negatively (positively) correlated. The interactions of market timing and price spread

of the institutional investors for the short trading interval indicate that they are significant negatively correlation. For the foreigners, during the short-term there is uncorrelated between overall trading and market timing however overall trading and price spread are significant positively correlated. The overall trading performance of individual investors is positively correlated with the price spread. When examining the long-term period, h=one quarter, institution, foreign, and individual traders appear to make long term price spread gains. While, all have a negative trading performance between the overall net trading and the market timing.

Table 6-6: Correlation of investor group performance in the spot market.

Table 6-6.1: Correlation of investor group performance between different trading sources, h = one day

	Overall Trading	Market Timing	Price Spread
Panel A: Institutional Investor			
Overall Trading	1	-0.090523788*	0.749826667**
Market Timing	-0.090523788*	1	-0.72679499**
Price Spread	0.749826667**	-0.72679499**	1
Panel B: Foreign Investors			
Overall Trading	1	-0.026165	0.923899**
Market Timing	-0.026165	1	-0.40668**
Price Spread	0.923899**	-0.40668**	1
Panel C: Individual Investors			
Overall Trading	1	0.005613	0.51438**
Market Timing	0.005613	1	-0.854662**
Price Spread	0.51438**	-0.854662**	1

Table 6-6.2: Correlation of investor group performance between different trading sources, h

= one week

	Overall Trading	Market Timing	Price Spread
Panel A: Institutional Investor			
Overall Trading	1	-0.123693**	0.76376**
Market Timing	-0.123693**	1	-0.639583**
Price Spread	0.76376**	-0.639583**	1
Panel B: Foreign Investors			
Overall Trading	1	-0.05886	0.723518**
Market Timing	-0.05886	1	-0.632228**
Price Spread	0.723518**	-0.632228**	1
Panel C: Individual Investors			
Overall Trading	1	-0.153958**	0.71444**
Market Timing	-0.153958**	1	-0.698826**
Price Spread	0.71444**	-0.698826**	1

Table 6-6.3: Correlation of investor group performance between different trading sources, h = one month

	Overall Trading	Market Timing	Price Spread
Panel A: Institutional Investor			
Overall Trading	1	0.090792*	0.564079**
Market Timing	0.090792*	1	-0.674449**
Price Spread	0.564079**	-0.674449**	1
Panel B: Foreign Investors			
Overall Trading	1	-0.018769	0.655669**
Market Timing	-0.018769	1	-0.677072**
Price Spread	0.655669**	-0.677072**	1
Panel C: Individual Investors			
Overall Trading	1	0.103833**	0.600461**

Market Timing	0.103833**	1	-0.612441**
Price Spread	0.600461**	-0.612441**	1

Table 6-6.4: Correlation of investor group performance between different trading sources, h = one quarter

	Overall Trading	Market Timing	Price Spread
Panel A: Institutional Investor			
Overall Trading	1	-0.028474	0.277602**
Market Timing	-0.028474	1	-0.905763*
Price Spread	0.277602**	-0.905763*	1
Panel B: Foreign Investors			
Overall Trading	1	-0.106228**	0.237156**
Market Timing	-0.106228**	1	-0.98819**
Price Spread	0.237156**	-0.98819**	1
Panel C: Individual Investors			
Overall Trading	1	-0.117856**	0.230679**
Market Timing	-0.117856**	1	-0.991322**
Price Spread	0.230679**	-0.991322**	1

Table 6-6 reports the correlations of overall net trading gains (Π_t) and its components, which are gains arising from price spreads (π_t^S) and gains arising from market timing (π_t^T), where $\Pi_t = \pi_t^S + \pi_t^T$, of Thai equity investors by separating investors into three types, which are institutions, foreigners, and individuals.

*Correlation is significant at the 0.05 level (2-tailed).

**Correlation is significant at the 0.01 level (2-tailed).

Table 6-7 reports the correlation of investor group performance between different trading sources, which are overall net trading gains, market timing, and price spread

in the Thailand's futures market. The results suggest that overall trading of all investor groups have a significantly positive trade performance with the price spread during the entire period. In addition, the trading performance between market timing and price spread of all investors group in the futures market are negative correlation.

Table 6-7: Correlation of investor group performance in the futures market.

Table 6-7.1: Correlation of investor group performance between different trading sources, h = one day

	Overall Trading	Market Timing	Price Spread
Panel A: Institutional Investor			
Overall Trading	1	-0.073781	0.52736**
Market Timing	-0.073781	1	-0.886188**
Price Spread	0.52736**	-0.886188**	1
Panel B: Foreign Investors			
Overall Trading	1	-0.065718	0.569875**
Market Timing	-0.065718	1	-0.857376**
Price Spread	0.569875**	-0.857376**	1
Panel C: Individual Investors			
Overall Trading	1	-0.086146*	0.555488**
Market Timing	-0.086146*	1	-0.876227**
Price Spread	0.555488**	-0.876227**	1

Table 6-7.2: Correlation of investor group performance between different trading sources, h = one week

	Overall Trading	Market Timing	Price Spread
Panel A: Institutional Investor			
Overall Trading	1	-0.026122	0.703182**

Market Timing	-0.026122	1	-0.632083**
Price Spread	0.703182**	-0.632083**	1
Panel B: Foreign Investors			
Overall Trading	1	-0.046765	0.724502**
Market Timing	-0.046765	1	-0.609649**
Price Spread	0.724502**	-0.609649**	1
Panel C: Individual Investors			
Overall Trading	1	-0.076283	0.728898**
Market Timing	-0.076283	1	-0.616927**
Price Spread	0.728898**	-0.616927**	1

Table 6-7.3: Correlation of investor group performance between different trading sources, h = one month

	Overall Trading	Market Timing	Price Spread
Panel A: Institutional Investor			
Overall Trading	1	0.024775	0.632099**
Market Timing	0.024775	1	-0.644352**
Price Spread	0.632099**	-0.644352**	1
Panel B: Foreign Investors			
Overall Trading	1	0.123617**	0.603572**
Market Timing	0.123617**	1	-0.63157**
Price Spread	0.603572**	-0.63157**	1
Panel C: Individual Investors			
Overall Trading	1	0.03996	0.602163**
Market Timing	0.03996	1	-0.68799**
Price Spread	0.602163**	-0.68799**	1

Table 6-7.4: Correlation of investor group performance between different trading sources, h = one quarter

	Overall Trading	Market Timing	Price Spread
Panel A: Institutional Investor			
Overall Trading	1	-0.027059	0.478949**
Market Timing	-0.027059	1	-0.84446**
Price Spread	0.478949**	-0.84446**	1
Panel B: Foreign Investors			
Overall Trading	1	0.004351	0.374615**
Market Timing	0.004351	1	-0.893924**
Price Spread	0.374615**	-0.893924**	1
Panel C: Individual Investors			
Overall Trading	1	0.021317	0.293341**
Market Timing	0.021317	1	-0.925711**
Price Spread	0.293341**	-0.925711**	1

Table 6-7 reports the correlations of overall net trading gains (Π_t) and its components, which are gains arising from price spreads (π_t^s) and gains arising from market timing (π_t^T), where $\Pi_t = \pi_t^s + \pi_t^T$, in the futures market by separating investors into three types, which are institutions, foreigners, and individuals.

*Correlation is significant at the 0.05 level (2-tailed).

**Correlation is significant at the 0.01 level (2-tailed).

To sum up, the evidence shows that some investor groups in Thailand are gains from market timing while others are gains from price spread. The results show a clear divergence between the performance of market timing and the performance of price spread. Both information-based and behavioral-based investors can gain or loss from their trading.

6.4 Summary and Conclusion

In this paper, I examine the trading performance of different investor types such as individual investors, institutional investors, and foreign investors. I develop a method that gauges the trading performance of investors. I use data from the Stock Exchange of Thailand and Thailand's futures market that allow us to examine performances of all investor types across the entire market. For trade performance, I employ trade-weighted measure of trading performance that decomposes the performance of equity trades into two sources; price spreads, and market timing. The main result implies that different investor types have different sources of equity trading gains and losses.

In particular, I find that the overall net trading performance of individual investors in the spot market experience positive return, they have success in performance from price spread whereas they experience poor market timing return. The positive price spreads for individual investors might reflect the investors' disposition to sell winning investments and hold onto losing investments. The poor market timing ability of individual investors could indicate poor ability in predicting market. Interestingly, the results exhibit that individuals make losses on their trade in the futures market; the findings that individual traders lose money from trading are consistent with several prior researches, Barber and Odean (2000) evaluate the timing of individual investors' trades at a large United States discount brokerage firm by using individual investors' portfolio returns and, when compared to various benchmarks, including the market portfolio and multifactor benchmarks, they find that individual investors earn poor net returns when adjusted for trading costs. They conclude that overconfidence can explain high trading levels and the resulting poor

performance of individual investors. Kamesaka et al. (2003) demonstrate that Japanese individual investors have poor market timing performance. Moreover, Barber et al. (2004) investigate the performance of individual investors in the Taiwanese stock market using trade data for all market participants during the five years ending in 1999, and find that individual investors under-perform. Kaniel et al. (2008), on the other hand, examine the investment choices of individual investors using a large cross-section of NYSE stocks, and find that individual buying predicts subsequent positive excess returns. Barber et al. (2014) document that individual investors account for virtually all day trading (over 99% of day traders and 95% of day trading volume). In an average year, 450,000 individual investors day trade. Of these, 277,000 engage in day trades that exceed $NT 600,000 ($US 20,000), but only about 20% of this population is able to profit after a reasonable accounting for trading costs.

On the other hand, I find that average foreign investors who believed to be the information-based traders that are more likely to have information advantage over other type make minor overall net trading gains in the futures market. Their gains arise from the good market timing but likely to incur large losses in the spot market from negative price spreads between sell and buy prices. The findings tie well with many studies, despite documentation in the literature of superior trading performance by foreign investors, some studies indicate that foreign investors do not necessarily have informational advantages over domestic investors. Choe et al. (2005), for instance, suggest that foreign investors' trade execution performance indicates that they do not have private information advantages over Korean individual investors. Dvořák (2005) finds domestic investors in Indonesia have an information advantage

over foreign investors on average, resulting in domestic investors actually having higher profits than foreign investors. Dvořák (2005) also demonstrates that domestic clients of global brokerages have higher profits than do foreign clients of global brokerages, suggesting that the combination of local information and global expertise leads to higher profits.

Specifically, I find that the average institutional investors make overall net trading gains from positive price spreads between sell and buy prices in the futures market. Moreover, they have positive overall performance in the spot market arising from price spread gains while they are bad market timers. The results are supported by evidence from several studies; for example, Kamesaka et al. (2003) find that institutional traders on the Taiwan Stock Exchange (TSE) are good market timers. Barber et al. (2004) find that Taiwanese institutional investors, in the presence of information and trading cost advantages, profit from uninformed investors. Institutional investors can be classified into insurance firms, banks, mutual funds, security firms, and non-financial corporations. Institutional traders are generally classified as information-based investors and can therefore potentially have informational advantages over other investor types. Institutional investors can have good firm-specific information through their dealings with companies, for instance, and can also have detailed share market supply and demand information through their dealings with other investors. Bae et al. (2006) demonstrate that the trading gains of institutional traders on the Japanese market tend to increase when domestic investors' trading gains decrease, thus indicating the potential for interesting dynamics between institutional traders and other investor types. The different performance might be due to mixed effect of the trading gains and losses arise from

trades between investor types that have different backgrounds.

Chapter 7. Conclusion

7.1 Introduction

This chapter concludes this thesis and summarizes all objectives that defined in chapter 1 and all research findings. This chapter is organized as follow. Section 7.2 provides summary of the thesis. Section 7.3 illustrates empirical findings of Chapter 4, Chapter 5, and Chapter 6. Section 7.4 discusses the contribution of this thesis to the existing knowledge. Section 7.5 provides the limitations of the study and recommendations for further research and Section 7.6 concludes this chapter.

7.2 Summary of the Thesis

This research is aimed to empirically examine whether a lead-lag relationship exists between Spot and Futures Market in Thailand and to attempt to identify profitable trading strategies via the use of the spot and futures markets in Thailand based on Error-Correction and the Cost of Carry Model. It is expected that the findings of this paper will identify the effect of the futures index contract in the Thai market and whether it can be used as a hedging instrument or price discovery tool. The lead-lag relationship of futures and spot index reflects how fast one market reflects new information relative to the other and how well it is linked. This research will examine whether the spot and futures index changes are predictable or not by using advanced econometric methodology. Moreover, this research focuses on the trading behavior of various investor types in the Stock Exchange of Thailand (SET) and Thailand's

Derivative Market in the aspects of their trading patterns and sources of trade performance. This research is undertaken to answer these research questions and to fill the gap in empirical research:

Research question: Is there any causal relationship between spot and futures price changes in Thailand? And if so, what is the direction of causality? Different types of investors are behaving differently or not between spot and futures market? Are the different investor types likely to provide different sources of trade performance in both spot and futures market?

The objectives of the research are:

- To examine whether there is a relationship between Spot and Futures Market.
- To find the direction of the relationship if one exists.
- To examine whether a profitable trading strategy exists between these two markets.
- To investigate trading patterns of foreign investors, institutional investors, and individual investors in both Spot and Futures Market.
- To investigate and compare trade performance of the investor by decomposing trade performance into two sources; trading price spreads, and market timing.

7.3 Empirical Findings

The empirical work in this research is organized in three chapters and the chapter specific findings are summarized within the respective chapter. In this section, I will answer the main research questions raised in this research.

7.3.1 Chapter Four - Empirical Findings and Discussion

Chapter four empirically investigates and analyzes the lead-lag relationship between the spot market and futures market, SET50 index and its futures contract, for the Thailand market during the sample period. The econometric tools like unit root tests, the Error-Correction Model (ECM) and the Cost of Carry Model were employed in the study. In rational, efficient market, returns on derivative and underlying securities should be perfectly contemporaneously correlated. Due to market imperfections, one of these two markets may reflect information faster. The Augmented Dickey Fuller tests employed in the study proved that both the selected markets were stationary series after first different, indicate that they are I(1) and the Granger Causality test proved unidirectional relationships between these markets.

Moreover, this study has examined throughout the relationship between SET50 index futures and SET50 index. Using ThaiDex SET50 Exchange-Traded Fund (TDEX) as an underlying instead of SET50 index is an alternative way to check whether lead-lag relationship will be if the underlying cash asset changes. The trading strategy will then be constructed based on the error-correction model and the lead-lag connection between spot and futures index. In order to find the profitable strategy, the best ECM in term of forecasting power is used.

The findings of this study indicate that SET50 index lead SET50 index futures as one might suggest. The results support many studies that the spot lead futures index. Reflection of new market wide information in the spot stock market is faster than in the futures market, for example, Gee and Karim (2005) analyzed the lead-lag relationship by using daily data between index futures and spot index but specifically in the Malaysian market. The error-correction model was used as the model to test for this relationship. They discovered that the spot index could lead futures price. Moreover, Lucian (2008) investigated the way price discovery works in the Romanian markets by using both cash and futures markets. The results indicated that the Romanian cash market leads the futures market by three to five minutes, when new information emerges, it is integrated in the two markets with different speeds, depending upon the characteristics of the markets and the investors involved. Bohl et al. (2009) investigated the impact of index futures on the underlying stock market by employing a Markov-switching-GARCH approach; they found that in spot market lead futures market in Poland. Furthermore, Cabrera et al. (2009) also investigated the price discovery of Euro and Japanese Yen exchange rates in three foreign exchange markets based on electronic trading systems: the CME GLOBEX regular futures, E-mini futures, and the EBS interdealer spot market. The results show that the spot market is found to consistently lead the price discovery process for both currencies during the sample period.

Besides, the result proves that there is a leading effect between TDEX and SET50 index futures. The best forecasting model using RMSE, MAE, MAPE, and percentage of correct direction criterions is the traditional ECM where the cointegration error term came from the simple linear regression (ECM1). With the

trading strategies based on this model, it can beat the market return even after allowing for transaction costs.

7.3.2 Chapter Five - Empirical Findings and Discussion

Chapter five provides the studies about the trading patterns of each investor type, which are foreign investors, institutional investors, and individual investors by using detailed records of trading activity, trading volume, and trading value by employing a unique data set of daily aggregated purchases and sales over a 2-year period on the Stock Exchange of Thailand (SET) and the Thailand's derivative market. I find that the buying and selling investment flows of these three investor groups are ranked as follows; the majority trader in the Stock Exchange of Thailand (SET) is the individual investor, followed by the foreign investor, and the institutional investor. The corresponding ranking in the Thailand's Derivative Market is the individual investor, then the institutional investor, and the foreign investor is the minority trader.

In addition, the results provide empirical evidence that foreign investors were net buyers whereas institutional investors and individual investors were net sellers of equities in both the spot and the futures market of Thailand. For the feedback-trading pattern, the results show that in both the spot and the futures market; foreign investors are positive feedback or momentum traders, which is consistent with many previous studies, for instance, Brennan and Cao (1997), who find U.S. equity investment in developed markets is positively related to foreign market return. Froot et al. (2001) find that foreign investors tend to employ momentum trading and

especially in emerging markets. Lin and Swanson (2003) find that foreign investors in Taiwan employ momentum strategies of buying past winners and selling past losers during the sample period from 1996 to 2003. Richards (2005) employed the regression and Vector Auto Regression (VAR) analysis also found strong evidence that foreign investors engage in momentum trading in six Asian emerging equity markets, which are the Jakarta Stock Exchange (JSX), Korea Stock Exchange (KSE), Philippine Stock Exchange (PSE), Stock Exchange of Thailand (SET), Taiwan Stock Exchange (TWSE), and Korean Securities Dealers Automated Quotations (Kosdaq) Stock Market.

While, individual investors tend to be contrarian investors, or negative feedback traders. The results are supported by several studies, for example, Odean (1999) studies behavior of individual investors in the U.S. and finds that individual investors tend to use contrarian trading strategies and Barber and Odean (2000) also indicate that on average individual investors are contrarian investors, they tend to buy stocks that have recently underperformed the market and sell stocks that have performed well in recent weeks. Grinblatt and Keloharju (2000) find contrarian tendencies of individual investors in Finland, which is similar to Bae et al. (2002) report that trading of Japanese individual investors follow contrarian-trading patterns. Richards (2005) finds individual investors in six Asian emerging markets are contrarian investors along with Kaniel et al. (2008) illustrate individual investors in U.S. trade as they are contrarian traders. In addition, Kaniel et al. (2012) study the behavior of individual investors who trade around earnings announcements using a data set of NYSE stocks and find that individual investors are contrarians.

Institutional investors' trading pattern in both spot and futures market is rather mixed results. Lakonishok et al. (1992) study the trading patterns of institutions in U.S. and find that they are momentum traders. While, Odean (1998) finds that the institutions in U.S. present evidence that is consistent with contrarian trading strategies. Similarly, Karolyi (2002) use Vector Auto Regression (VAR) analysis indicate that institutional traders in Japan follow contrarian trading pattern. Kamesaka et al. (2003) employ the net investment flow and VAR method; they find that institutional investors in Japan follow contrarian trading. On the other hand, Ng and Wu (2007) report that institutions in China who trade during the sample period from 2001 to 2002 are momentum traders. Shyu and Sun (2010) investigate the herding behavior of institutional investors in Taiwan's stock market and presented that institutional herding exists in Taiwan's stock market. De Haan and Kakes (2011) indicate that three types of institutions, which are pension funds, life insurers, and non-life insurers in Netherlands and the results present that all three investor types tend to be contrarian trader.

Furthermore, the results show that foreign investors have a significantly positive autocorrelation with their past NIF. Further, foreign investors' herding is positively correlated with institutional traders in spot market, while negatively correlated with institutional investors in futures market. Foreign investors' herding is negatively correlated with individual investors in both spot and futures market. Institutional investors' trade flow is positively correlated with individual investor in futures market whereas it is negatively correlated with individual investors in spot market. Individuals have a negative trade flow correlation with both foreign and institutional traders in both spot and futures market.

7.3.3 Chapter Six - Empirical Findings and Discussion

Chapter six investigates investors' performance and trading sources between spot and futures market. This study decomposes the performance of equity trades into two sources, which are price spreads, and market timing. The main result implies that different investor types have different sources of equity trading gains and losses. The empirical analysis reveals that the overall net trading performance of individual investors in the spot market experience positive return, they have success in performance from price spread whereas they experience poor market timing return. The positive price spreads for individual investors might reflect the investors' disposition to sell winning investments and hold onto losing investments. The poor market timing ability of individual investors could indicate poor ability in predicting market. Interestingly, the results exhibit that individuals make losses on their trade in the futures market. The findings that individual traders lose money from trading tie well with several previous researches, Barber and Odean (2000) evaluate the timing of individual investors' trades at a large United States discount brokerage firm by comparing to various benchmarks, including the market portfolio and multifactor benchmarks, they find that individual investors earn poor net returns when adjusted for trading costs. Kamesaka et al. (2003) reveal that Japanese individual investors have poor market timing performance. Besides, Barber et al. (2004) investigate the performance of individual investors in the Taiwanese stock market using trade data for all market participants during the five years ending in 1999, and find that individual investors have negative trading performance. Kaniel et al. (2008) examine the investment choices of individual investors using a large cross-section of NYSE stocks, and find that individual buying predicts subsequent positive excess returns.

Barber et al. (2014) employ the trade weighted intraday return and find that individual investors who trade in Taiwan during the sample period from 1992 to 2006 earn poor net returns.

For foreign investors, who believed to be the information-based traders that are more likely to have information advantage over other type make minor overall net trading gains in the futures market. Their gains arise from the good market timing but likely to incur large losses in the spot market from negative price spreads between sell and buy prices. Theses findings are supported by many studies. Choe et al. (2005), for instance, suggest that foreign investors' trade execution performance indicates that they do not have private information advantages over Korean individual investors. Dvořák (2005) finds domestic investors in Indonesia have an information advantage over foreign investors on average, resulting in domestic investors actually having higher profits than foreign investors. Dvořák (2005) also demonstrates that domestic clients of global brokerages have higher profits than do foreign clients of global brokerages, suggesting that the combination of local information and global expertise leads to higher profits. For institutional investors, the results find that on average they make overall net trading gains from positive price spreads between sell and buy prices in the futures market. Moreover, they have positive overall performance in the spot market arising from price spread gains while they are bad market timers. The results are consistent with several evidences from many studies; for example, Kamesaka et al. (2003) find that institutional traders on the Taiwan Stock Exchange (TSE) are good market timers. Barber et al. (2004) find that Taiwanese institutional investors, in the presence of information and trading cost advantages, profit from uninformed investors. Institutional investors can be classified into insurance firms,

banks, mutual funds, security firms, and non-financial corporations. Institutional traders are generally classified as information-based investors and can therefore potentially have informational advantages over other investor types. Institutional investors can have good firm-specific information through their dealings with companies, for instance, and can also have detailed share market supply and demand information through their dealings with other investors. Bae et al. (2006) demonstrate that the trading gains of institutional traders on the Japanese market tend to increase when domestic investors' trading gains decrease, thus indicating the potential for interesting dynamics between institutional traders and other investor types. Overall, the different performance might be due to mixed effect of the trading gains and losses arise from trades between investor types that have different backgrounds.

7.4 Contributions of the Thesis

The contribution of this research to the existing body of knowledge is to provide empirical evidence on whether there exists a lead-lag relationship between the cash or spot market and the futures market in Thailand. If a lead-lag relationship does exist the study will then attempt to identify a trading strategy to make an abnormal profit by using knowledge of the lead-lag relationship. Moreover, the findings from this paper have important implications, not only for the Thai stock market in particular, but for both spot and futures markets in general, as it provided additional evidence that the momentum and contrarian occur in both spot and futures market. The study of trading behavior becomes increasingly important role in order to help facilitate the development of the capital market, especially in an emerging market.

However, regarding investors from emerging markets, the knowledge about their investing behavior is very limited. Therefore, to address this gap in the literature, in this research, I present the trading patterns and trading performance of various investor types and differentiate this work from previous studies by focusing on both the Stock Exchange of Thailand (SET) and Thailand's Derivative Market. This research contributes to the existing literature in many ways. This research fills the gap in the literature by investigating the existence of lead lag relationship and investor trading pattern in the Thai markets, Thailand remains among the most important emerging markets awaiting such investigations because the volume of the trading in both the spot and futures markets in Thailand has been increasing over time. In addition, I developed a framework for examining investors trading behavior in terms of separating investors into three groups and focusing on both spot and futures market. Furhtermore, I have sufficient data to determine the behavior of each type of investors and the data was collected from Stock Exchange of Thailand and Thailand's derivative market that has high quality and reliability.

7.5 Limitations and Recommendation for Further Research

The results from this research can be extended for other people who want to further study in this area. Previous studies in this area have mainly examined data for developing countries, raising the issue of whether the results are similar or different when using data from emerging countries. The present study try to remedy this limitation by focusing on an emerging country like Thailand during the recent time period. Although, various issues on the lead-lag relationship, trading strategy, and investor behavior have been addressed and the findings and implications are

appealing, ambiguities also exist. The interesting question is whether this lead-lag relationship between spot index and futures contract would be if the market is bigger and mature. Separation of the periods to find if the result still be consistent is one appropriate way when the data from the futures market are large enough. The trading strategy can be developed further in order to find the most realistic strategy that can consistently outperform the market. One might investigate whether the return of the strategy in this paper looks like when the market is rising. Obvious extensions to this research include studying trading behavior of various investor types from other emerging countries that have a similar structure of trading.

7.6 Conclusion

In summary, this PhD research examines whether a lead-lag relationship exists between Spot and Futures Market in Thailand, whether spot and futures index changes are predictable or not and to attempt to identify profitable trading strategies via the use of the spot and futures markets in Thailand. Moreover, this research focuses on the trading behavior of various investor types, which are foreign investors, institutional investors, and individual investors in both the Stock Exchange of Thailand (SET) and Thailand's Derivative Market in the aspects of their trading patterns and sources of trade performance.

The empirical examination presented in this thesis shows that there is a price discovery for the futures index, the lagged of changes in spot price has a leading effect to the changes in the futures price. Alternatively, the TDEX is used instead of the SET50 index to see any changes in the lead-lag relationship. The result proves

that there is a leading effect between TDEX and SET50 index futures. The trading strategy based on the error correction model, which utilizes the traditional linear model can outperform the market even after allowing for transaction costs.

For the trading pattern, the results show that in both the spot and the futures market; foreign investors are positive feedback or momentum traders. While, individual investors tend to be contrarian investors, or negative feedback traders. Institutional investors' trading pattern in both spot and futures market is rather mixed results. Moreover, the results reveal that different investor types can have different performance. Foreign investors gain in the futures market, their gains arise from the good market timing but likely to incur large losses in the spot market from negative price spreads between sell and buy prices. Individuals make losses on their trade in the futures market while they experience positive return in the spot market, they have success in performance from price spread whereas they experience poor market timing return. Institutional investors make overall net trading gains from positive price spreads between sell and buy prices in both spot and futures market. The different performance might be due to mixed effect of the trading gains and losses arise from trades between investor types that have different backgrounds.

References

Abhyankar, A. (1998). Linear and nonlinear Granger causality: Evidence from the UK stock index futures market. *Journal of Futures Markets, 18*(5), 519-540.

Admati, A. R., & Pfleiderer, P. (1988). A theory of intraday patterns: Volume and price variability. *Review of Financial studies, 1*(1), 3-40.

Aduda, J., Odera, E. R., & Onwonga, M. (2012). The Behaviour and Financial Performance of Individual Investors in the Trading Shares of Companies Listed At the Nairobi Stock Exchange, Kenya. *Journal of Finance and Investment Analysis, 1*(3), 33-60.

Agarwal, S., Faircloth, S., Liu, C., & Rhee, S. G. (2009). Why do foreign investors underperform domestic investors in trading activities? Evidence from Indonesia. *Journal of Financial Markets, 12*(1), 32-53.

Bae, K. H., Ito, K., & Yamada, T. (2002). How do foreigners profit from local investors? Evidence from trades in the Japanese stock market. *Evidence from Trades in the Japanese Stock Market (May 2002).*

Bae, K. H., Yamada, T., & Ito, K. (2006). How do Individual, Institutional, and Foreign Investors Win and Lose in Equity Trades? Evidence from Japan*. *International Review of Finance, 6(3-4)*, 129-155.

Bae, K. H., Ozoguz, A., Tan, H., & Wirjanto, T. S. (2012). Do foreigners facilitate information transmission in emerging markets?. *Journal of Financial Economics, 105*(1), 209-227.

Bae, S. C., Min, J. H., & Jung, S. (2011). Trading Behavior, Performance, and Stock Preference of Foreigners, Local Institutions, and Individual Investors: Evidence from the Korean Stock Market. *Asia-Pacific Journal of Financial Studies, 40*(2), 199-239.

Bailey, W., & Jagtiani, J. (1994). Foreign ownership restrictions and stock prices in the Thai capital market. *Journal of financial economics, 36*(1), 57-87.

Baker, C., & Phongpaichit, P. (2014). *A history of Thailand*. Cambridge University Press.

Balke, N.S. & Fomby, T.B. (1997). Threshold cointegration. *International Economic Review 38*, 627-645.

Barber, B. M., Lee, Y. T., Liu, Y. J., & Odean, T. (2007). Is the aggregate investor reluctant to realise losses? Evidence from Taiwan. *European Financial Management*, *13*(3), 423-447.

Barber, B. M., Lee, Y. T., Liu, Y. J., & Odean, T. (2009). Just how much do individual investors lose by trading?. *Review of Financial studies*, *22*(2), 609-632.

Barber, B. M., Lee, Y. T., Liu, Y. J., & Odean, T. (2014). The cross-section of speculator skill: Evidence from day trading. *Journal of Financial Markets*, *18*, 1-24.

Barber, B. M., & Odean, T. (1999). The courage of misguided convictions. *Financial Analysts Journal, 55*(6), 41-55.

Barber, B. M., & Odean, T. (2000). Trading is hazardous to your wealth: The common stock investment performance of individual investors. *Journal of Finance, 55*, 773– 806.

Barber, B. M., & Odean, T. (2001). Boys will be boys: Gender, overconfidence, and common stock investment. *Quarterly journal of Economics,* 261-292.

Barber, B. M., Odean, T., & Zhu, N. (2009). Do retail trades move markets?. *Review of Financial Studies, 22*(1), 151-186.

Basak, S., & Cuoco, D. (1998). An equilibrium model with restricted stock market participation. *Review of Financial Studies, 11*(2), 309-341.

Bec, F., & Rahbek, A. (2004). Vector equilibrium correction models with non-linear discontinuous adjustments. *The Econometrics Journal, 7*(2), 628-651.

Banerjee, A. V. (1992). A simple model of herd behavior. *The Quarterly Journal of Economics*, 797-817.

Bhandari, A., & Kamaiah, B. (2015). An Analysis of Lead-Lag Relationship Between Stock Returns Using Spectral Methods. *IUP Journal of Applied Economics*, *14*(1).

Birru, J. (2015). Confusion of Confusions: A Test of the Disposition Effect and Momentum. *Review of Financial Studies*, hhv007.

Bisman, J. (2010). Postpositivism and accounting research: A (personal) primer on critical realism. *Australasian Accounting, Business and Finance Journal, 4*(4), 3-25.

Bohl, M. T., Brzeszczyński, J., & Wilfling, B. (2009). Institutional investors and stock returns volatility: Empirical evidence from a natural experiment. *Journal of Financial Stability, 5*(2), 170-182.

Bohl, M. T., Salm, C. A., & Wilfling, B. (2011). Do individual index futures investors destabilize the underlying spot market?. *Journal of Futures Markets, 31*(1), 81-101.

Bohn, H., & Tesar, L. L. (1996). US equity investment in foreign markets: portfolio rebalancing or return chasing?. *The American Economic Review*, 77-81.

Brennan, M. J., & Cao, H. H. (1997). International portfolio investment flows. *Journal of Finance,* 1851-1880.

Brennan, M. J., Jegadeesh, N., & Swaminathan, B. (1993). Investment analysis and the adjustment of stock prices to common information. *Review of Financial Studies, 6*(4), 799-824.

Brenner, R. J., & Kroner, K. F. (1995). Arbitrage, cointegration, and testing the unbiasedness hypothesis in financial markets. *Journal of Financial and Quantitative Analysis, 30*(01), 23-42.

Brooks, C., Rew, A. G., & Ritson, S. (2001). A trading strategy based on the lead–lag relationship between the spot index and futures contract for the FTSE 100. *International Journal of Forecasting, 17*(1), 31-44.

Bryman, A., & Bell, E. (2011). *Business research methods* (3rd ed.): Oxford University Press, USA.

Cabrera, J., Wang, T., & Yang, J. (2009). Do futures lead price discovery in electronic foreign exchange markets?. *Journal of futures markets, 29*(2), 137-156.

Cai, F., & Zheng, L. (2004). Institutional trading and stock returns. *Finance Research Letters, 1*(3), 178-189.

Campbell, J. Y. (2006). Household finance. *The Journal of Finance, 61*(4), 1553-1604.

Caner, M., & Hansen, B. E. (2001). Threshold autoregression with a unit root. *Econometrica, 69*(6), 1555-1596.

Chabchitrchaidol, A., & Permpoon, O. (2002). Development of the Thai bond market. *The development of bond markets in emerging economies, BIS Papers*, *11*, 190-199.

Chan, K., Menkveld, A. J., & Yang, Z. (2008). Information asymmetry and asset prices: Evidence from the China foreign share discount. *The Journal of Finance, 63*(1), 159-196.

Chang, Y., Park, J. Y., & Phillips, P. C. (2001). Nonlinear econometric models with cointegrated and deterministically trending regressors. *The Econometrics Journal, 4*(1), 1-36.

Chatrath, A., Christie-David, R., Dhanda, K. K., & Koch, T. W. (2002). Index futures leadership, basis behavior, and trader selectivity. *Journal of Futures Markets, 22*(7), 649-677.

Chen, J. H. (2014). Return Volatility Movements in Spot and Futures Markets: Evidence from Intraday Behavior of the S&P 500 Index. *The International Journal of Business and Finance Research, 8*(3), 95-107.

Chen, Y. L., & Gau, Y. F. (2009). Tick sizes and relative rates of price discovery in stock, futures, and options markets: Evidence from the Taiwan Stock Exchange. *Journal of Futures Markets, 29*(1), 74-93.

Chen, S. L., & Wu, J. L. (2005). Long-run money demand revisited: evidence from a non-linear approach. *Journal of International Money and Finance, 24*(1), 19-37.

Choe, H., Kho, B. C., & Stulz, R. M. (1999). Do foreign investors destabilize stock markets? The Korean experience in 1997. *Journal of Financial Economics, 54*(2), 227-264.

Choe, H., Kho, B. C., & Stulz, R. M. (2005). Do domestic investors have an edge? The trading experience of foreign investors in Korea. *Review of Financial Studies, 18*(3), 795-829.

Choi, I., & Saikkonen, P. (2004). Testing linearity in cointegrating smooth transition regressions. *The Econometrics Journal, 7*(2), 341-365.

Chordia, T., & Swaminathan, B. (2000). Trading volume and cross-autocorrelations in stock returns. *The Journal of Finance, 55*(2), 913-935.

Chow, Y. F. (2001). Arbitrage, risk premium, and cointegration tests of the efficiency of futures markets. *Journal of Business Finance & Accounting, 28*(5-6), 693-713.

Chowdhury, A. R. (1997). The financial structure and the demand for money in Thailand. *Applied Economics*, *29*(3), 401-409.

Corradi, V., Swanson, N. R., & White, H. (2000). Testing for stationarity-ergodicity and for comovements between nonlinear discrete time Markov processes. *Journal of Econometrics, 96*(1), 39-73.

Creswell, J. W., & Clark, V. L. P. (2011). *Designing and conducting mixed methods research* (2nd ed.). Thousand Oaks, CA: Sage.

De Bondt, W. F., & Thaler, R. (1985). Does the stock market overreact?. *The Journal of Finance, 40*(3), 793-805.

De Bondt, W. F., & Thaler, R. H. (1987). Further evidence on investor overreaction and stock market seasonality. *The Journal of Finance, 42*(3), 557-581.

De Haan, L., & Kakes, J. (2011). Momentum or contrarian investment strategies: evidence from Dutch institutional investors. *Journal of Banking & Finance, 35*(9), 2245-2251.

Dahlquist, M., & Robertsson, G. (2004). A note on foreigners' trading and price effects across firms. *Journal of Banking & Finance, 28*(3), 615-632.

Dhar, R., & Kumar, A. (2001). *A Non-Random Walk Down the Main Street: Impact of Price Trends on Trading Decisions of Individual Investors* (No. ysm208). Yale School of Management.

Dickey, D. A., & Fuller, W. A. (1981). Likelihood ratio statistics for autoregressive time series with a unit root. *Econometrica: Journal of the Econometric Society*, 1057-1072.

Dvořák, T. (2005). Do domestic investors have an information advantage? Evidence from Indonesia. *The Journal of Finance, 60*(2), 817-839.

Engle, R. F., & Granger, C. W. (1987). Co-integration and error correction: representation, estimation, and testing. *Econometrica: journal of the Econometric Society*, 251-276.

Fama, E. F. (1965). The behavior of stock-market prices. *The Journal of Business, 38*(1), 34-105.

Fama, E.F. (1970). Efficient capital markets: A review of theory and empirical work. *The Journal of Finance, 25*(2), 383–417.

Fama, E.F. (1998). Market efficiency, long-term returns, and behavioral finance. *Journal of Financial Economics, 49*(3), 283–306.

Feng, L., & Seasholes, M. S. (2005). Do investor sophistication and trading experience eliminate behavioral biases in financial markets?. *Review of Finance, 9*(3), 305-351.

Feng, L., & Seasholes, M. S. (2008). Individual investors and gender similarities in an emerging stock market. *Pacific-Basin Finance Journal, 16*(1), 44-60.

Finnerty, J. E., & Park, H. Y. (1987). Stock index futures: Does the tail wag the dog?. *Financial Analysts Journal, 43*(2), 57-61.

Fleming, J., Ostdiek, B., & Whaley, R. E. (1996). Trading costs and the relative rates of price discovery in stock, futures, and option markets. *Journal of Futures Markets, 16*(4), 353-387.

Froot, K. A., O'connell, P. G., & Seasholes, M. S. (2001). The portfolio flows of international investors. *Journal of Financial Economics, 59*(2), 151-193.

Froot, K. A., & Ramadorai, T. (2008). Institutional portfolio flows and international investments. *Review of Financial Studies, 21*(2), 937-971.

Gee, C. S., & Karim, M. Z. A. (2005). The lead-lag relationship between stock index futures and spot market in Malaysia: A Cointegration and Error Correction Model approach. *Chulalongkorn Journal of Economics, 17*(1), 53-72.

Gervais, S., & Odean, T. (2001). Learning to be overconfident. *Review of Financial studies, 14*(1), 1-27.

Ghosh, A. (1993). Cointegration and error correction models: Intertemporal causality between index and futures prices. *Journal of futures markets, 13*(2), 193-198.

Glaser, M., & Weber, M. (2007). Why inexperienced investors do not learn: they do not know their past portfolio performance. *Finance Research Letters, 4*(4), 203-216.

Goetzmann, W. N., & Massa, M. (2002). Daily momentum and contrarian behavior of index fund investors. *Journal of Financial and Quantitative Analysis, 37*(3), 375-389.

Gonzalo, J., & Granger, C. (1995). Estimation of common long-memory components in cointegrated systems. *Journal of Business & Economic Statistics, 13*(1), 27-35.

Gonzalo, J., & Pitarakis, J. Y. (2006). Threshold Effects in Cointegrating Relationships. *Oxford Bulletin of Economics and Statistics, 68*(s1), 813-833.

Griffin, J. M., Harris, J. H., & Topaloglu, S. (2003). The dynamics of institutional and individual trading. *The Journal of Finance, 58*(6), 2285-2320.

Grinblatt, M., & Keloharju, M. (2000). The investment behavior and performance of various investor types: a study of Finland's unique data set. *Journal of financial economics, 55*(1), 43-67.

Grinblatt, M., & Keloharju, M. (2001). What makes investors trade? *Journal of Finance, 56,* 589-616.

Granger, C. W. (1986). Developments in the study of cointegrated economic variables. *Oxford Bulletin of economics and statistics, 48*(3), 213-228.

Guba, E. G., & Lincoln, Y. S. (1994). Competing paradigms in qualitative research. *Handbook of qualitative research, 2*, 163-194.

Hamao, Y., & Mei, J. (2001). Living with the "enemy": an analysis of foreign investment in the Japanese equity market. *Journal of International Money and Finance, 20*(5), 715-735.

Hansen, B. E., & Seo, B. (2002). Testing for two-regime threshold cointegration in vector error-correction models. *Journal of econometrics, 110*(2), 293-318.

Harris, L. (2002). *Trading and exchanges: Market microstructure for practitioners.* Oxford University Press.

Hasbrouck, J. (1995). One security, many markets: Determining the contributions to price discovery. *Journal of Finance, 50*(4), 1175-1199.

Hirshleifer, D. (2001). Investor psychology and asset pricing. *Journal of finance,* 1533-1597.

Hirshleifer, D., Subrahmanyam, A., & Titman, S. (1994). Security analysis and trading patterns when some investors receive information before others. *Journal of Finance*, 1665-1698.

Hou, K. (2007). Industry information diffusion and the lead-lag effect in stock returns. *Review of Financial Studies, 20*(4), 1113-1138.

Hou, K., & Moskowitz, T. J. (2005). Market frictions, price delay, and the cross-section of expected returns. *Review of Financial Studies, 18*(3), 981-1020.

Hu, W. Y., Huang, C. J., Chang, H. Y., & Lin, W. J. (2015). The Effect of Investor Sentiment on Feedback Trading and Trading Frequency: Evidence from Taiwan Intraday Data. *Emerging Markets Finance and Trade, 51*(sup1), S111-S120.

Huang, B.N., Yang, C. W., & Hwang, M. J. (2009). The dynamics of a nonlinear relationship between crude oil spot and futures prices: A multivariate threshold regression approach. *Energy Economics, 31*(1), 91-98.

Iihara, Y., Kato, K., & Tokunaga, T. (1996). Intraday return dynamics between cash and the futures markets in Japan. *The Journal of Futures Markets 16*(2), 147-162.

Jackline, S., & Deo, M. (2011). Lead-lag relationship between the futures and spot prices. *Journal of Economics and International Finance, 3*(7), 424-427.

Jegadeesh, N., & Titman, S. (1993). Returns to buying winners and selling losers: Implications for stock market efficiency. *The Journal of Finance, 48*(1), 65-91.

Jeon, B. N., & Seo, B. (2003). The impact of the Asian financial crisis on foreign exchange market efficiency: The case of East Asian countries. *Pacific-Basin Finance Journal*, *11*(4), 509-525.

Johansen, S. (1988). Statistical analysis of cointegration vectors. *Journal of economic dynamics and control, 12*(2), 231-254.

Johansen, S., & Juselius, K. (1990). Maximum likelihood estimation and inference on cointegration—with applications to the demand for money. *Oxford Bulletin of Economics and statistics 52*(2), 169-210.

Kamesaka, A., Nofsinger, J. R., & Kawakita, H. (2003). Investment patterns and performance of investor groups in Japan. *Pacific-Basin Finance Journal, 11*(1), 1–22.

Kaniel, R., Saar, G., & Titman, S. (2008). Individual investor trading and stock returns. *Journal of Finance, 63,* 273−310.

Kaniel, R., Liu, S., Saar, G., & Titman, S. (2012). Individual investor trading and return patterns around earnings announcements. *The Journal of Finance, 67*(2), 639-680.

Kang, J. K., & Stulz, R. (1997). Why is there a home bias? An analysis of foreign portfolio equity ownership in Japan. *Journal of Financial Economics, 46*(1), 3-28.

Kang, J., Liu, M. H., & Ni, S. X. (2002). Contrarian and momentum strategies in the China stock market: 1993–2000. *Pacific-Basin Finance Journal, 10*(3), 243-265.

Kang, J., Lee, C. J., & Lee, S. (2006). An empirical investigation of the lead-lag relations of returns and volatilities among the KOSPI200 spot, futures and options markets and their explanations. *Journal of Emerging Market Finance, 5*(3), 235-261.

Kapetanios, G., Shin, Y., & Snell, A. (2003). Testing for a unit root in the nonlinear STAR framework. *Journal of Econometrics, 112*(2), 359-379.

Kapetanios, G., Shin, Y., & Snell, A. (2006). Testing for cointegration in nonlinear smooth transition error correction models. *Econometric Theory, 22*(2), 279-303.

Karolyi, A. G. (2002). Did the Asian financial crisis scare foreign investors out of Japan?. *Pacific - Basin Finance Journal 10,* 411 –442.

Kavussanos, M. G., & Nomikos, N. K. (2003). Price discovery, causality and forecasting in the freight futures market. *Review of Derivatives Research*, *6*(3), 203-230.

Kawaller, I.G., Koch, P.D., & Koch, T.W. (1987). The temporal price relationship between S&P 500 futures and the S&P 500 index. *The Journal of Finance, 42*(5), 1309-1329.

Kılıç, R. (2011). Testing for a unit root in a stationary ESTAR process. *Econometric Reviews, 30*(3), 274-302.

Kim, S., & Lee, G. (2010). Effects of Macroeconomic News Announcements on Risk-neutral Distribution: Evidence from KOSPI200 Intraday Options Data. *Asia-Pacific Journal of Financial Studies*, *40*(3), 403-432.

KTB. (2014). *2014 investor relations annual report of Krungthai Bank*. Retrived from http://www.ktb.co.th/ktb/Download/investorrelations/InvestorRelationsDownload_102KTB_Annual_Report_2014_EN.pdf

Kung, J. J., & Carverhill, A. P. (2005). A cointegration study of the efficiency of the US Treasury STRIPS market. *Applied Economics, 37*(6), 695-703.

Lakonishok, J., Shleifer, A., & Vishny, R. W. (1992). The impact of institutional trading on stock prices. *Journal of Financial Economics, 32*(1), 23–43.

Leitch, G., & Tanner, J. E. (1991). Economic forecast evaluation: profit versus the conventional error measures. *The American Economic Review, 81*(3), 580-590.

Li, B., Qiu, J., & Wu, Y. (2010). Momentum and seasonality in Chinese stock markets. *Journal of Money Investment and Banking, 17,* 24-36.

Lin, A. Y., & Swanson, P. E. (2003). The Behavior and Performance of Foreign Investors in Emerging Equity Markets: Evidence from Taiwan. *International Review of Finance, 4*(3-4), 189–210.

Lo, A.W. (2004). The adaptive markets hypothesis: market efficiency from an evolutionary perspective. *The Journal of Portfolio Management, 30*(5), 15–29.

Lo, A. W., & MacKinlay, A. C. (1990). When are contrarian profits due to stock market overreaction?. *Review of Financial studies, 3*(2), 175-205.

Lucian, S. (2008). *Lead–Lag Relationship between the Romanian Cash Market and Futures Market* (No. 26). Bucharest University of Economics, Center for Advanced Research in Finance and Banking-CARFIB.

Luukkonen, R., Saikkonen, P., & Teräsvirta, T. (1988). Testing linearity against smooth transition autoregressive models. *Biometrika, 75*(3), 491-499.

Mackay, C. (1841). Extraordinary Popular Delusions and the Madness of Crowds. Reprinted in MS Frisdon. 1996. Confusions and Delusions: Tulipmania, the South Sea Bubble and the Madness of Crowds. Hoboken, NJ: John Wiley & Sons.

Malkiel, B.G. (2003). The efficient market hypothesis and its critics. *The Journal of Economic Perspectives, 17*(1), 59–82.

Malkiel, B. G., & Fama, E. F. (1970). Efficient Capital Markets: A Review Of Theory And Empirical Work. *Journal of Finance, 25*(2), 383-417.

Malkiel, B., Mullainathan, S., & Stangle, B. (2005). Market efficiency versus behavioral finance. *Journal of Applied Corporate Finance, 17*(3), 124-136.

McQueen, G., Pinegar, M., & Thorley, S. (1996). Delayed reaction to good news and the cross autocorrelation of portfolio returns. *The Journal of Finance, 51*(3), 889-919.

Merton, R. C. (1987). A simple model of capital market equilibrium with incomplete information. *The Journal of Finance, 42*(3), 483-510.

Neuman, W.L. (2000). Social Research Methods (5th edn). London: Pearson.

Ng, L., & Wu, F. (2007). The trading behavior of institutions and individuals in Chinese equity markets. *Journal of Banking & Finance, 31*(9), 2695-2710.

Nofsinger, J. R., & Sias, R. W. (1999). Herding and feedback trading by institutional and individual investors. *The Journal of Finance, 54*(6), 2263-2295.

Norden, L. & M. Weber (2009). The Co-movement of Credit Default Swap, Bond and Stock Markets: an Empirical Analysis. *European Financial Management, 15*(3), 529-562.

Odean, T. (1998). Are investors reluctant to realize their losses?. *The Journal of finance, 53*(5), 1775-1798.

Odean, T. (1999). Do investors trade too much?. *American Economic Review, 89,* 1279–1298.

Park, C. H., & Irwin, S. H. (2007). What do we know about the profitability of technical analysis?. *Journal of Economic Surveys, 21*(4), 786-826.

Pizzi, M. A., Economopoulos, A. J., & O'Neill, H. M. (1998). An examination of the relationship between stock index cash and futures markets: A cointegration approach. *The Journal of Futures Markets, 18*(3), 297-305.

Racine, M. D., & Ackert, L. F. (2000). Time-Varying Volatility in Canadian and US Stock Index and Index Futures Markets: A Multivariate Analysis. *Journal of Financial Research, 23*(2), 129-143.

Rashes, M. S. (2001). Massively confused investors making conspicuously ignorant choices (mci–mcic). *The Journal of Finance, 56*(5), 1911-1927.

Richards, A. (2005). Big fish in small ponds: The trading behavior of foreign investors in Asian emerging equity markets. *Journal of Financial and Quantitative Analysis, 40*(1), 1-27.

Roope, M., & Zurbruegg, R. (2002). The intra-day price discovery process between the Singapore Exchange and Taiwan Futures Exchange. *Journal of Futures Markets, 22*(3), 219-240.

Rothman, P., Van Dijk, D., & Hans, P. F. (2001). Multivariate STAR analysis of money-output relationship. *Macroeconomic Dynamics, 5*(4), 506-532.

Saikkonen, P. (2005). Stability results for nonlinear error correction models. *Journal of Econometrics, 127*(1), 69-81.

Saikkonen, P. (2007). Stability of regime switching error correction models under linear cointegration. *Econometric Theory, 24*(1), 294-318.

Samadi, S., Parvarde, A., & Haghighi, M. K. (2011). Theoretical Pricing of Future Contracts of Gold Coin in Stochastic Processes Model. *Interdisciplinary Journal of Contemporary Research In Business*, *3*(5), 76.

Sarno, L., & Valente, G. (2000). The cost of carry model and regime shifts in stock index futures markets: An empirical investigation. *Journal of Futures Markets*, *20*(7), 603-624.

Saunders, M., Lewis, P., & Thornhill, A. (2009). *Research methods for business students* (5th ed.). England: Pearson Education Limited.

Schreiber, P. & Schwartz, R. (1986). Price discovery in securities markets. *The Journal of Portfolio Management, 12*(4), 43-48.

Schwert, G.W. (2003) Anomalies and market efficiency. In G.M. Constantinides, M.Harris and R.M. Stulz (eds), *Handbook of the Economics of Finance*, 937–972.

SET. (2014). *2014 annual report of the stock exchange of Thailand*. Retrieved from http://www.set.or.th/en/about/annual/files/annual_report_2014_eng_v2.pdf

Shapira, Z., & Venezia, I. (2001). Patterns of behavior of professionally managed and independent investors. *Journal of Banking & Finance, 25*(8), 1573-1587.

Shapiro, A. (2002). The investor recognition hypothesis in a dynamic general equilibrium: Theory and evidence. *Review of Financial Studies, 15*(1), 97-141.

Sharpe, W. F., Alexander, G. J., & Bailey, J. V. (1999). *Investments, 6.* Upper Saddle River, NJ: Prentice-Hall.

Shefrin, H. (2001). Behavioral corporate finance. *Journal of Applied Corporate Finance, 14*(3), 113-126.

Shefrin, H., & Statman, M. (1985). The disposition to sell winners too early and ride losers too long: Theory and evidence. *Journal of Finance*, 777-790.

Shyu, J., & Sun, H. M. (2010). Do Institutional Investors Herd in Emerging Markets? Evidence from the Taiwan Stock Market. *Asian Journal of Finance & Accounting, 2*(2).

Shyy, G., Vijayraghavan, V., & Quinn, B. S. (1996). A further investigation of the lead-lag relationship between the cash market and stock index futures market with the use of bid/ask quotes: The case of France. *Journal of Futures Markets, 16*(4), 405-420.

So, R.W., & Tse, Y. (2004). Price discovery in the Hang Seng index markets: index, futures, and the tracker fund. *Journal of Futures Markets, 24*(9), 887-907.

Spagnolo, F., Sola, M., & Psaradakis, Z. (2004). On Markov error-correction models, with an application to stock prices and dividends. *Journal of Applied Econometrics, 19*(1), 69-88.

Stoll, H. R., & Whaley, R. E. (1990). The dynamics of stock index and stock index futures returns. *Journal of Financial and Quantitative Analysis, 25*(4), 441-468.

Swanson, N. R. (1999). Finite sample properties of a simple LM test for neglected nonlinearity in error-correcting regression equations. *Statistica neerlandica, 53*(1), 76-95.

Thaler, R. (1980). Toward a positive theory of consumer choice. *Journal of Economic Behavior & Organization, 1*(1), 39-60.

Tse, Y. K. (1995). Lead-lag relationship between spot index and futures price of the nikkei stock average. *Journal of Forecasting, 14*(7), 553-563.

Wahab, M., & Lashgari, M. (1993). Price dynamics and error correction in stock index and stock index futures markets: A cointegration approach. *Journal of Futures Markets, 13*(7), 711-742.

Walliman, N. (2006). *A Step by Step Guide for the First-Time Researcher* (2nd ed). London: Sage.

Wright, A. (2008). *Twentieth century impression of Siam*. London&c: Lloyds Greater Britain Publishing Company.

Yang, J., Bessler, D. A., & Leatham, D. J. (2001). Asset storability and price discovery in commodity futures markets: a new look. *Journal of futures markets, 21*(3), 279-300.

Yang Jian, Yang Zihui & Shou Yinggang. (2012). Intraday price discovery and volatility transmission in stock index and stock index futures markets: Evidence from China. *Journal of Futures Markets, 32*(2)*,* 99–121.

Yen, G., & Lee, C. F. (2008). Efficient market hypothesis (EMH): past, present and future. *Review of Pacific Basin Financial Markets and Policies, 11*(2), 305-329.

Zhou, Z., Dong, H., & Wang, S. (2014). Intraday Volatility Spillovers between Index Futures and Spot Market: Evidence from China. *Procedia Computer Science, 31,* 721-730.